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IDENTIFIERS	Gender Issues; Informal Learning

ABSTRACT

This document contains the final program and abstracts of the 1996 National Association for Research in Science Teaching (NARST) Annual Meeting. The presentations are classified in the following strands: (1) Learning: Students' Conceptions and Conceptual Change; (2) Learning: Classroom Contexts and Learner Characteristics; (3) Teaching; (4) Teacher Education; (5) Curriculum, Evaluation, and Assessment; (6) Cultural, Social, and Gender Issues; (7) Educational Technology; (8) History, Philosophy, and Epistemology; (9) Sessions in the Spanish Language; and (10) Informal Learning. First authors' addresses and a participant index are also included. (JRH)

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NARST National Association for Research in Science Teaching

Final Program and Abstracts

1996 NARST Annual Meeting

Science Education for the 21st Century: Creating a Culture for Collaboration

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Hyatt Regency at Union Station
St. Louis, Missouri, USA
March 31- April 3, 1996

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NATIONAL ASSOCIATION FOR RESEARCH IN SCIENCE TEACHING

Final Program and Abstracts

1996 NARST ANNUAL MEETING

Science Education for the 21st Century: Creating a Culture for Collaboration

Sunday, March 31-Wednesday, April 3, 1996
Hyatt Regency at Union Station
St. Louis, Missouri U.S.A.

Gender, Science and Mathematics
Shortening the Shadow

edited by:
Lesley H. Parker, *Curtin University of Technology, Perth, Australia;*
Léonie J. Rennie, *Curtin University of Technology, Perth, Australia;*
Barry J. Fraser, *Curtin University of Technology, Perth, Australia*

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The theme of *Gender, Science and Mathematics* is that change agents, such as teachers and curriculum writers, have a key role in the translation of gender equity policy into gender equitable practices in science and mathematics education.
The first section emphasizes that a necessary prerequisite for successful action is for scientists, students, teachers, teacher trainees, curriculum writers and researchers to confront the many different and often conflicting perspectives on the relationship between gender, science and mathematics. The second section presents a number of analyses of the reality of schools, classrooms, curriculum and assessment. Finally, the third section describes a variety of projects that have achieved some success in bringing about more equitable science and mathematics education. Ways are suggested in which future research and action can build on these expectations.

The book provides vivid examples and adopts a practical approach. The recent research and thinking presented has a wide and general applicability.
Audience: Designed for use throughout the world in university and college courses and by policy makers concerned with the gender/science/mathematics relationship.

Contents and Contributors
Introduction and overview; *L.H. Parker, et al.* **I: Confronting perceptions and attitudes. 1.** Science in a masculine straightjacket; *J. Harding.* **2.** Towards a gender-inclusive science in schools: confronting student teachers' perceptions and attitudes; *S.M. Haggerty.* **3.** Examining and extending young children's views of science and scientists; *T. Jarvis.* **4.** Gender justice and the mathematics curriculum: four perspectives; *S. Willis.* **5.** Revealing assumptions: problematising research on gender and mathematics and science education; *J. Johnston, M. Dunne.* **II: The reality of schools, classrooms, curriculum and assessment. 6.** Under cover of night: (re)gendering mathematics and science education; *T. Evans.* **7.** Patterns of science achievement: international comparisons; *J.P. Keeve, D. Kotte.* **8.** Equity in the mathematics classroom: beyond the rhetoric; *G.C. Leder.* **9.** Assessment practices and gender in science; *P.F. Murphy.* **10.** Gender equity and the enacted science curriculum; *K. Tobin.* **11.** Equitable science education: a discrepancy model; *J.B. Kahle.* **III: From policy to practice-building on experience. 12.** The role of credible communicators in implementing gender-equity initiatives; *T.R. Koballa Jr.* **13.** Sharing science: primary science for both teachers and pupils; *D. Jorde, A. Lea.* **14.** 'Do you know anyone who builds skyscrapers?' SOS-skills and opportunities in science for girls; *B.Farmer.* **15.** The politics and practice of equity: experiences from both sides of the Pacific; *N. Kreinberg, S. Lewis.* **16.** Informing teaching and research in science education through gender equity initiatives; *L. Rennie, et al.*

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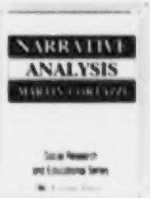

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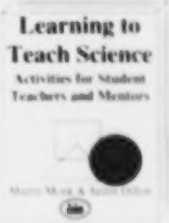

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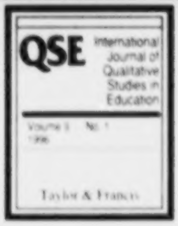

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International Conference on Science, Mathematics & Technology Education

Conference Theme: Science, Mathematics and Technology Education and National Development

Venue: Hanoi – Vietnam, 6 – 9 January 1997

Jointly organised by the National Key Centre for School Science and Mathematics, Curtin University of Technology, Perth, Australia and the Hanoi Pedagogy University, Vietnam National University, Vietnam

This unique conference will provide an intellectually challenging and culturally enriching experience for science and mathematics teachers, teacher educators, researchers and administrators at the elementary, secondary and higher education levels from around the world. There will be an opportunity to interact and exchange innovative ideas, research findings and practical implications in the traditional fields of science, mathematics and technology as well as new areas of international significance related to the conference theme of Science, Mathematics and Technology Education and National Development.

Hanoi is the ancient capital of Vietnam with its leafy streets, picturesque lakes and interesting historic legends. Hanoi, with its traditional beauty, profound culture and fascinating history is proud to host this conference. It is expected many participants of different academic and professional backgrounds around the world will meet in this historic city of Vietnam.

The Conference will include the following themes related to science, mathematics and technology education, but papers on other themes are welcome:

- Learning
- Gender Issues
- Constructivism
- Cultural context
- Curriculum Issues
- Elementary education
- Research methodology
- Assessment & evaluation
- Learning environments
- International education
- Educational technology
- Secondary education
- Computer-assisted learning
- Technological development
- Environmental studies
- Distance education
- Communication & language
- Higher education

The conference will include keynote addresses, symposia, papers, posters and workshop presentations. Participants will be invited to submit their presentations for consideration for inclusion in a book of conference proceedings. An area will be set aside for exhibits. A social and sightseeing program will be organised in conjunction with the conference.

A number of conference sessions have been reserved for NARST members' presentations.

Further information about this conference can be obtained by visiting the exhibit about this conference in the exhibits area at the 1996 NARST annual meeting in St Louis, or by consulting the conference brochure provided to everyone registering at the 1996 NARST meeting.

Inquiries can be addressed to Associate Professor Darrell Fisher (Conference convenor), National Key Centre for School Science & Mathematics, Curtin University of Technology, GPO Box U1987, Perth 6001, Australia. Telephone +61 9 351 3110, fax +61 9 351 2503, Electronic Mail ifisherd@info.curtin.edu.au

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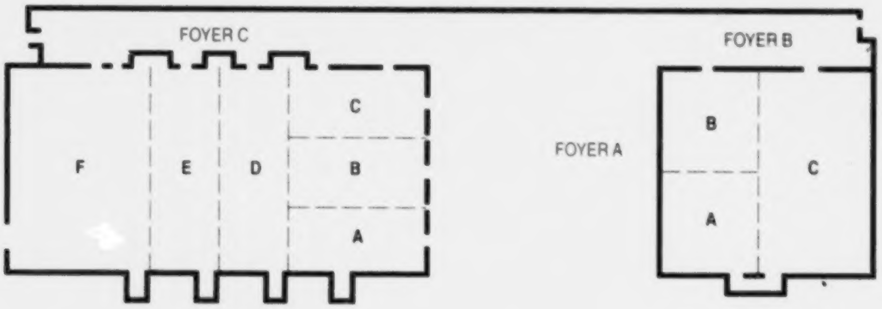
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GRAND BALLROOM

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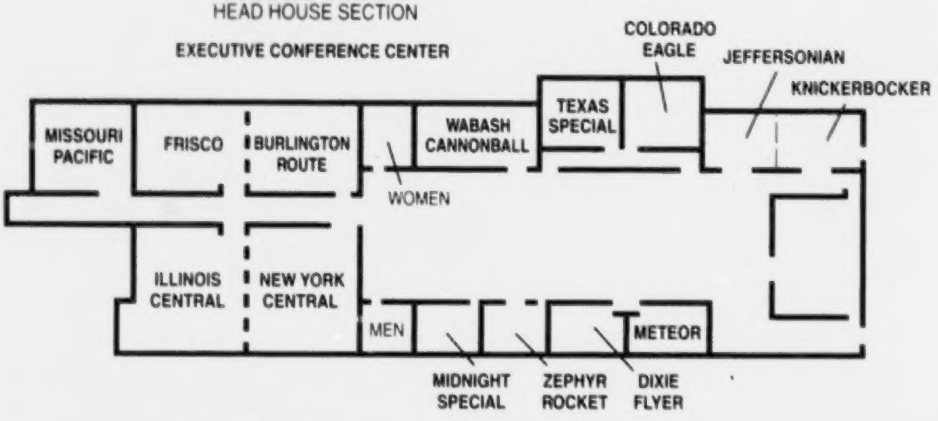
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ROOM	SIZE	SQUARE FEET	CEILING HEIGHT	BANQUET	RECEPTION	THEATRE	SCHOOLROOM	CONFERENCE	HOLLOW SQUARE
GRAND BALLROOM	180' x 90'	16,200	20'	1,520	1,800	1,600	900	–	–
F	60' x 90'	5,400	20'	460	600	475	280	–	–
E or D	30' x 90'	2,700	20'	130	250	250	90	72	88
A, B or C	60' x 30'	1,800	20'	120	200	160	90	52	64
E and F or A-D	90' x 90'	8,100	20'	610	900	800	450	–	–
E and D or A, B and C	60' x 90'	5,400	20'	460	600	475	280	–	–
A and B	60' x 60'	3,600	20'	240	400	300	180	52	96
D, E and F	120' x 90'	10,800	20'	900	1,200	900	750	–	–
REGENCY BALLROOM	90' x 90'	8,100	18'	610	1,000	900	500	–	–
C	45' x 90'	4,000	18'	280	450	450	270	60	88

Guidelines For Presiders

Paper Sets

- Go to designated room early. Arrange room furniture to suit the type of session. Check overhead projector and other audiovisual equipment.
- Meet and greet presenters and discussant (if assigned). Check the pronunciations of names and institutional affiliations.
- Agree on the order and time allotments for presentations, questioning and discussion.
- Urge audience to sit near front or to adjust to optimal seating pattern.
- Start session promptly. Also dismiss it on time.
- Hold presenters to the agreed time schedule. Hold up cards marked '3 minutes', '1 minute', 'Time is up!' Stand up if necessary.
- Adjust lamps and window shades for desired lighting. Leave door open to encourage late arrivals but close it if necessary.
- Adjust overhead projector if not focused or not framed on screen. Turn it off if not in continuous use. Assist with use of other AV equipment.
- Assist presenters to pass out their papers.
- Monitor questions. Keep questions, brief, civil and on the topic. Assure fair involvement.

Symposia

Discussion and questioning is controlled by the proposer with the assistance of the discussant (if designated). Discussion should promote the expression of alternative viewpoints and theoretical positions.

Discussion Groups

Discussion group presentations are quite informal and of short duration. Most of the session time is devoted to dialogue between presenters and audience and is usually monitored by the assigned discussant. The presider should negotiate these shorter presentation times with the presenters.

Round Tables

In round table sessions, each presenter is assigned a table and makes a short, informal presentation followed by discussion which he/she controls. Presider responsibilities:

- Help each presenter find and set up at the table assigned and identified by a member of the program committee.
- Assist audience participants to find the appropriate table.
- Give a five-minute warning of the session ending time.
- Dismiss on time.

Guidelines For Discussants

Read papers before the session. Interject new ideas and differing viewpoints. Make brief and cogent summary with suggestions for further research.

Acknowledgements

The 1996 NARST Annual Meeting Program and Abstracts book was prepared at the University of Georgia in Athens, Georgia by the following members of the Program Committee:

Thomas R. Koballa, Jr. (Chair)
Deborah J. Tippins
David F. Jackson
William Veal
Elizabeth Doster
Katherine Wieseman

Extensive and skilful database support was provided by Carol Bartges and Joseph Bartges.

PART A

General Information

Information about NARST

The National Association for Research in Science Teaching was founded in 1928 for the purpose of promoting research in science education at all educational levels and disseminating the findings of this research in such ways as to improve science teaching. The Association is incorporated as a non-profit corporation in the State of Minnesota. The official publication is the *Journal of Research in Science Teaching*.

NARST encourages the conduct and presentation of the results of a wide variety of investigations in all aspects of science education, including action, historical, philosophical, ethnographic, experimental and evaluative studies. Reports of empirical research, critical reviews and theoretical works are encouraged. Some research areas of interest to NARST members include curriculum development and organization, assessment and evaluation, learning theory, teacher education, programs for the talented and handicapped, equity studies and methods of teaching.

Current membership is about 1400, the highest ever. Approximately 20% are non-US, making NARST a truly international organization. Almost 65% have joined since 1990. Approximately 40% of the members attend the annual meetings.

The Association's headquarters are located with the office of the Executive Secretary. Inquiries regarding membership and other matters should be addressed to: Dr Arthur L. White, NARST Executive Secretary, Ohio State University, 1929 Kenny Rd., Columbus, OH 43210, USA. Telephone: 614-292-1597, Fax: 614-292-1595
E-Mail: TS0002@OHSTMVSA.ACS.OHIO-STATE.EDU.

How NARST Keeps its Members Informed

- Ten issues of the *Journal of Research in Science Teaching* (JRST). The Journal has been ranked as one of the highest quality educational journals according to studies published by War, Holland and Schramm (*American Educational Research Journal*) and Guba and Clark (*Educational Researcher*) for the American Educational Research Association (AERA). These authors identified JRST as clearly the top research journal in science education.
- Abstracts of research papers presented at the annual meeting.
- Quarterly newsletter describing recent developments in research and in the profession. Opportunities to work with prominent people throughout the world on research projects and with such affiliated organizations as the National Science Teachers Association (NSTA) and the American Association for the Advancement of Science (AAAS).

NARST Outstanding Paper Award Submissions

Presenters wishing to have their papers considered for the 1995 Outstanding Paper Award must place one copy in the box marked "1995 NARST Outstanding Paper Award" located near the registration table at the 1995 Annual Meeting. In late April, the Chairperson will request that the first author send 8 copies of the paper with names and affiliations of all authors removed. Authors have six weeks to send in copies of their paper.

The newly elected Executive Board Members who will serve as Chairperson of the NARST Outstanding Awards Committee will be identified at the meeting.

Explanation of Program Session Formats

SYMPOSIUM: A symposium presents a single important issue, controversial topic or area of research. One or more short presentations are made and summarized by a designated discussant. The discussant promotes and coordinates active debate and discussion among the participants.

PAPER SET: A paper set format consists of 3-5 research reports on the same or similar topic. Some sets are arranged by a proposer; others are grouped by the program committee. While audience discussion is important, most of the session time is devoted to presentations.

DISCUSSION GROUP: A discussion group format is similar to a paper set but the presentations are shorter and more informal. Most of the session time is for dialogue among presenters and participants.

ROUND TABLE: In this format, a single paper is presented informally to a small group seated at a round table or in a circle. The purpose of this format is to promote intimate discussion of the topic by those intensely interested in it.

POSTER: This format is a visual display of text, graphs, charts, photographs, etc. on a poster board with display space of 4 by 4 feet (1.2m by 1.2m). Presenters talk informally with participants who move among the displays.

OTHER: Other formats may include presentations by invited speakers, audiovisual demonstrations, debates, and others of a novel nature.

Strand Key

STRAND 1	Learning: Students' Conceptions and Conceptual Change
STRAND 2	Learning: Classroom Contexts and Learner Characteristics
STRAND 3	Teaching
STRAND 4	Teacher Education
STRAND 5	Curriculum, Evaluation and Assessment
STRAND 6	Cultural, Social and Gender Issues
STRAND 7	Educational Technology
STRAND 8	History, Philosophy and Epistemology
STRAND 9	Sessions in the Spanish Language
STRAND 10	Informal Learning

Technology/Resources Room

Midnight Special

Following the success of the Technology/Resources Room at previous conferences, Gerald Abegg (Educational Technology Strand Coordinator) will coordinate a similar room at the 1996 NARST annual meeting. The Technology/Resources Room will be housed in the Midnight Special Room, although space stringency means that some strand sessions also will have to be scheduled in the same room. The Technology/Resources Room will provide conference participants with facilities for viewing videotapes and examining commercial computer software, as well as a place to meet to discuss issues in educational technology. Limited provisions for copying floppy disks also could be available.

A Special Thanks to Sponsors

John Wiley and Sons, Publishers, for their sponsorship of the JRST Editorial Board Meeting and Dinner.

Kluwer Academic Publishers, for their sponsorship of the Special Session for Past-Presidents, Executive Secretaries and Recipients of the Distinguished Contributions Through Research Award.

Publishers' Exhibits

At this year's NARST annual meeting, the following eight publishers will exhibit their books in the Lower Lobby:

- ***Carfax***
- ***ERIC Clearinghouse for Science, Mathematics, and Environmental Education***
- ***History of Science Society***
- ***Kluwer Academic Publishers***
- ***Lawrence Erlbaum Associates, Inc., Publishers***
- ***Taylor & Francis/Falmer Press***
- ***Teachers College Press***
- ***Waveland Press, Inc.***

NARST Leadership Team 1995–1996

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1997 NARST Annual Meeting

"Visit the Windy City"

The **Program Chair** invites NARST members and others to plan to participate in the 1997 NARST annual meeting and especially urges all members to start planning program proposals now during this year's conference.

VENUE:

Hyatt Regency Oak Brook
1909 Spring Rd
Oak Brook, IL 60521

Telephone: 708-573-1234 Fax: 708-573-1133

DATES: **Friday, March 21 to Monday, March 24, 1997** immediately preceeding the annual meeting of the American Education Research Association (25-29 March) in Chicago.

SUBMISSION DEADLINE: Program proposals for the 1997 annual meeting must be received by strand coordinators by **15 August 1996.** The deadline allows sufficient time for processing and evaluating the many of proposals. The call for proposals will appear in the March and June issues of *NARST News*.

FURTHER INFORMATION:

Kathleen Fisher, 1997 Program Coordinator
CRMSE
San Diego State University
6475 Alvarado Rd. #206
San Diego, CA 92120
Telephone: 619-594-4453 Fax: 619-594-8557
E-mail: KFISHER@SCIENCES.SDSU.EDU

Future Meeting Dates for NARST, NSTA and AERA

1997	NARST	Oak Brook, IL	March 21-24
	AERA	Chicago	March 25-29
	NSTA	New Orleans	April 3-6
1998	AERA	San Diego	April 14-18
	NSTA	Las Vegas	April 16-19
	NARST	San Diego	April 19-22
1999	NARST	Date and Location To Be Announced	

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Randy Yerrick
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Curtin University

John Staver (ex-officio)
Kansas State University

Arthur White (ex-officio)
Ohio State University

Program Committee Members and Strand Coordinators

STRAND A	*Learning: Students' Conceptions and Conceptual Change* Pat Keig, California State University, Fullerton
STRAND B	*Learning: Classroom Contexts and Learner Characteristics* William Holliday and Maureen McMahon, University of Maryland
STRAND C	*Teaching* Randy Yerrick, East Carolina University Gail Jones, University of North Carolina at Chapel Hill
STRAND D	*Teacher Education* Charlene Czerniak and Andrew Lumpe, University of Toledo
STRAND E	*Curriculum, Evaluation, and Assessment* Rodney Doran, State University at Buffalo Chin-Tang Liu, University of Iowa
STRAND F	*Cultural, Social, and Gender Issues* Kate Scantlebury, University of Deleware
STRAND G	*Educational Technology* Gerald Abegg, Boston University
STRAND H	*History, Philosophy, and Epistemology* Cathy Loving, Texas A & M University
STRAND I	*Sessions in the Spanish Language* Alejandro Gallard, Florida State University Ramón Mata-Toledo, James Madison University
STRAND J	*Informal Learning* Bernadette Peiffer, SCI TREK

Program Proposal Assessors

Program proposals were given blind reviews by a group of assessors which included members of the Program Committee and the following:

Daryl Adams
Mankato State University

Glen Aikenhead
University of Saskatchewan

Richard Audet
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NARST Award Winners

Distinguished Contributions to Science Education Through Research Award

This award is given at the annual meeting but is bestowed only when a superior candidate is identified. It is given to recognize an individual who, through research over an extended period of time, has made outstanding and continuing contributions, provided notable leadership, and made a substantial impact in the area of science education.

Year	Awardee	Year	Awardee
1986	Anton E. Lawson	1991	Robert L. Shrigley
1987	Paul DeHart Hurd	1992	Pinchas Tamir
1988	John W. Renner	1993	Jack Easley, Jr
1989	Willard Jacobson	1994	Marcia C. Linn
1990	Joseph D. Novak	1995	Wayne W. Welch

JRST Award

The JRST Award is given annually for the article published in the *Journal of Research in Science Teaching* during the previous year and judged to be the most significant for that year.

Year	Awardee	Year	Awardee
1974	Donald E. Riechard and	1987	Russell H. Yeany
	Robert C. Olson		Kueh Chin Yap and
1975	Mary Budd Rowe		Michael J. Padilla
1976	Marcia C. Linn and	1988	Kenneth G. Tobin and
	Herbert C. Thier		James J. Gallagher
1977	Anton E. Lawson and		(tie) Robert D. Sherwood
	Warren T. Wollman		Charles K. Kinzer
1978	Dorothy Gabel and		John D. Bransford and
	J. Dudley Herron		Jeffrey J. Franks
1979	Janice K. Johnson and		(tie) Anton E. Lawson
	Ann C. Howe		(tie) Anton E. Lawson
1980	John R. Staver and	1990	Richard A. Duschl and
	Dorothy Gabel		Emmett L. Wright
	(tie) Linda R. DeTure	1991	E. P. Hart and
1981	William C. Kyle, Jr		I. M. Robottom
1982	Robert G. Good and	1992	John R. Baird
	Harold J. Fletcher		Peter J. Fensham
	(tie) F. David Boulanger		Richard E. Gunstone and
1983	Jack A. Easley, Jr		Richard T. White
1984	Marcia C. Linn	1993	Nancy R. Romance and
	Cathy Clement and		Michael R. Vitale
	Stephen Pulos	1994	E. David Wong
1985	Julie P. Sanford	1995	Stephen P. Norris and
1986	Anton E Lawson		Linda M. Phillips

Outstanding Paper Award

The Outstanding Paper Award is given annually for the paper or research report presented at the annual meeting that is judged to have the greatest significance and potential in the field of science education.

Year	Awardee
1975	John J. Koran
1976	Anton E. Lawson
1977	no award
1978	Rita Peterson
1979	Linda R. DeTure
1980	M. James Kozlow and Arthur L: White
1981	William Capie Kenneth G. Tobin and Margaret Boswell
1982	F. Gerald Dillashaw and James R. Okey
1983	William C. Kyle, Jr James A. Shymansky and Jennifer Alport
1984	Darrell L. Fisher and Barry J. Fraser
1985	Hanna J. Arzi Ruth Ben-Zvi and Uri Ganiel (tie) Russell H. Yeany Kuch Chin Yap and Michael J. Padilla
1986	Barry J. Fraser Herbert J. Walberg and Wayne W. Welch
1987	Robert D. Sherwood
1988	Barry J. Fraser and Kenneth G. Tobin
1989	James J. Gallagher and Armando Contreras
1990	Patricia L. Hauslein Ronald G. Good and Catherine Cummins
1991	Nancy R. Romance and Michael Vitale
1992	Patricia Heller Ronald Keith and Scott Anderson
1993	Wolff-Michael Roth
1994	Wolff-Michael Roth and Michael Bosen
1995	Wolff-Michael Roth

Outstanding Doctoral Dissertation Award

This award was established in 1992 to be given annually for the doctoral dissertation judged to have the greatest significance in the field of science education.

Year	Awardee	Major Professor
1992	Rene Stofflett	Dale Baker
1993	Julie Gess-Newsome	Norman Lederman
1994	Carolyn W. Keys	Burton Voss
1995	Jerome M. Shaw	Edward Haertel

Outstanding Master's Thesis Award

This award was established in 1995 to be given annually for the master's thesis judged to have the greatest significance in the field of science education.

Year	Awardee	Major Professor
1995	Moreen K. Travis	Carol Stussey

Early Career Research Award

The Early Career Research Award is given annually to the early researcher (the recipient will have received his/her doctoral degree within five years of receiving the award) who demonstrates the greatest potential to make outstanding and continuing contributions to educational research.

Year	Awardee
1993	Wolff-Michael Roth
1994	Deborah J. Tippins
1995	Nancy Songer

Classroom Applications Award

The Classroom Applications Award was established in 1979. The award was given annually to authors whose papers were presented at the previous annual meeting and judged to be outstanding in terms of emphasizing classroom application of research in science education. The award was presented for the last time in 1991.

Year	Awardee
1980 Five Equal Awards	Livingston S. Schneider and John W. Renner Heidi Kass and Allan Griffiths Ramona Saunders and Russell H. Yeany Joe Long, James R. Okey and Russell H. Yeany M. James Kozlow and Arthur L. White
1981 Four Equal Awards	Dorothy Gabel, Robert D. Sherwood and Larry G. Enochs Wayne Welch, Ronald D. Anderson and Harold Pratt Mary Ellen Quinn and Carolyn Kessler P. Ann Miller and Russell H. Yeany
1982 Four Equal Awards	Louise L. Gann and Seymour Fowler Dorothy L. Gabel and Robert D. Sherwood Thomas L. Russell Joseph C. Cotham
1983	Robert D. Sherwood, Larry G. Enochs and Dorothy Gabel
1984 Four Equal Awards	Mary Westerback, Clemencia Gonzales and Louis H. Primavera Kenneth G. Tobin Hanna J. Arzi, Ruth Ben-Zvi and Uri Ganiel Charles Porter and Russell H. Yeany
1985 Three Equal Awards	Dan L. McKenzie and Michael J. Padilla Margaret Walkosz and Russell H. Yeany Kevin C. Wise and James R. Okey
1986 Four Equal Awards	Sarath Chandran, David F. Treagust and Kenneth G. Tobin Darrell L. Fisher and Barry J. Fraser Dorothy L. Gabel, Stanley L. Helgeson, Joseph D. Novak, John Butzow and V. K. Samuel Linda Cronin, Meghan Tweist and Michael J. Padilla
1987	Dorothy L. Gabel, V. K. Samuel, Stanley L. Helgeson, Saundra McGuire, Joseph D. Novak and John Butzow
1988	Uri Zoller and Benn Chaim
1989	James D. Ellis and Paul J. Kuerbis
1990	Dale R. Baker, Michael D. Piburn and Dale S. Niederhauser
1991	Carl F. Berger, Billie Jean Edwards and David F. Jackson

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PART B

Annual Meeting Program

SUNDAY March 31, 1996

Program Overview

Session	Room	Time
Registration	FOYER A, B, C	8:00 am – 8:00 pm
Executive Board Meeting	WABASH CANNONBALL	8:00 am – 4:00 pm
Preconference Tours City of St. Louis 1904 World's Fair		 10:00 am - 3:00 pm 10:00 am - 3:00 pm
Presession Workshops		
Using Video as a Research and Case Study Development Tool Jan Altman, Elliott Mitchell (Vanderbilt University)	ILLINOIS CENTRAL	9:30 am – 12:00 pm
Using and Researching Curriculum Design Tools Carl Berger, Joseph Krajcik (University of Michigan)	ILLINOIS CENTRAL	1:00 pm – 3:30 pm
General Session *Three Modest Proposals for Improving Teaching and Learning in Science* Elliot Eisner (Stanford University)	GRAND D, E, F	4:00 pm – 5:30 pm
Next Generation of Researchers' Orientation (including international members) William G. Holliday, Christine M. Kelly (University of Maryland)	NEW YORK CENTRAL	6:00 pm – 7:00 pm
STRAND SESSIONS	rooms as listed in schedule	7:00 pm – 8:30 pm
Reception for New Members, Including Poster Session	REGENCY A, B, C	8:30 pm - 10:00 pm

SUNDAY March 31, 1996

Strand Highlights

Sponsor	Session	Time & Room
STRAND B	*The Nature of Collaborative Conversations About Science and Education in School Settings and at Professional Meetings* Emily H. van Zee, Marletta Iwasyk, Akiko Kurose, Dorothy Simpson	7:00 pm – 8:30 pm GRAND D
STRAND G	*Access of NARST'S World Wide Web Internet Server and the Development of Similar Servers* Joseph Peters	7:00 pm – 8:30 pm MIDNIGHT SPECIAL

4:00 PM — 5:30 PM General Session Sunday, March 31, 1996

Three Modest Proposals for Improving the Teaching and Learning of Science **Grand D, E, F**

Presider: Thomas R. Koballa, Jr., *University of Georgia*

Presenter:

Elliot W. Eisner, *Stanford University*

7:00 PM — 8:30 PM Strand Sessions Sunday, March 31, 1996

Science Learning and Museum Settings **Burlington Route**

(J Informal Learning: Paper Set Grouped by Committee)

Presider: Linda Shore, *Exploratorium Teacher Institute*

Elementary Students' Alternative Frameworks About the Dinosaurs

Chi-Chin Chin, *National Museum of Natural Science, Republic of China*

A Study of a Science Apprenticeship Program in a Museum Setting

Scott P. Lewis, *Altamonte Springs, Florida*; Esther Oey, *University of California at Los Angeles*

Visitor Understanding of Interactive Exhibits: A Study of Family Groups in a Public Aquarium

Kodi R. Jeffrey, James H. Wandersee, *Louisiana State University*

The Multimedia Enhanced Middle School **Frisco**

(G Educational Technology: Paper Set Organized by Proposer)

Presider: Cindy L. Doherty, *Florida State University*

Research Opportunities in the Multimedia Enhanced Science Classroom

George O. Dawson, *Florida State University*

Cognitive and Affective Outcomes Resulting from State-Wide Field Testing of an Interactive Multimedia Environmental Science Program

Troy D. Palmer, *Florida State University*

Is an Interactive Multimedia Program the Key to Strengthening Thinking Skill?

Rebecca A. Dundle, *Florida State University & DeLand Middle School*

A Sociocultural Look at a Multimedia Middle School Science Curriculum

Cindy L. Doherty, *Florida State University*

Feminist Perspectives on Science Teacher Education **Grand A**

(D Teacher Education: Novel Format)

Presider: Lawrence C. Scharmann, *Kansas State University*

Discussant: Deborah Pomeroy, *Beaver College*

Participants:

Kathleen J. Roth, *Michigan State University*; Angela Calabrese Barton, *Hofstra University*; Lynne Cavazos, *University of California, Santa Barbara*; Constanza Hazelwood, Elaine Virginia Howes, Lori Kurth, *Michigan State University*; Margery Osborne, *University of Illinois, Urbana-Champaign*; Gail Richmond, *Michigan State University*

The Application of Worldview Theory To Science Education Research **Grand B**

(B Learning: Classroom Contexts and Learner Characteristics: Paper Set Organized by Proposer)

Presider: William W. Cobern, *Arizona State University West*

Discussant: Zoubeida Dagher, *University of Delaware*

Leaving Elementary School with A Sense of Order in Nature

Scott A. Underwood, Adrienne T. Gibson, *Cactus Shadows High School*; William W. Cobern, *Arizona State University West*

Ninth Graders Talk About Conservation and the Environment

Adrienne T. Gibson, Scott A. Underwood, *Cactus Shadows High School*; William W. Cobern, *Arizona State University West*

The Different Worlds of Biology and Physical Science Teachers

William W. Cobern, *Arizona State University West*; Adrienne T. Gibson, Scott A. Underwood, *Cactus Shadows High School*

Preservice Elementary School Teachers' Views of Nature and the Natural World

Peter Rillero, William W. Cobern, *Arizona State University West*

Change Is Learning Something New: Teacher Research and Systemic Reform in Science Education — Grand C

(D Teacher Education: Symposium)

Presider: Judith Johnson, *University of Central Florida*

Participants:

Judith Johnson, *University of Central Florida*; Beth Farina, *Hopper Center*; Larry Meadows, *Beaumont Elementary School*; Mary Neal, *Crooms School of Choice*; Terry Nelson, *South Seminole Middle School*; Malinda Ponton, *Columbia Elementary School*; Julie Townsend, *Lake Orienta Elementary School*

The Nature of Collaborative Conversations About Science and Education in School Settings and at Professional Meetings — Grand D

(B Learning: Classroom Contexts and Learner Characteristics: Symposium)

Presider: Emily H. van Zee, *University of Maryland*

Discussant: Linda S. Shore, *Exploratorium Teacher Institute*

Participants:

Emily H. van Zee, *University of Maryland*; Marletta Iwasyk, Akiko Kurose, *Seattle School District*; Dorothy Simpson, *Mercer Island School District*

Models of Science Teacher Enhancement — Illinois Central

(C Teaching: Paper Set Grouped by Committee)

Presider: James Gallagher, *Michigan State University*

Changes in Teacher Cognition with Problem-Solving Instruction: Instructional Planning of Science Activities

Carol L. Stuessy, Dawn Parker, *Texas A & M University*

Experiencing Scientific Inquiry and Pedagogy: A Model for Inservice Training for Science Education Reform

David L. Radford, Linda L. Ramsey, *Louisiana Tech University*

Grassroots Science Teacher-Leader Institute: Change from within

Claudia Khourey-Bowers, *Canton City Schools*

Teachers As Scientists? Examining the Effects of Teacher and Scientist Collaborative Teaming

Michele R. Estep, Randy K. Yerrick, *East Carolina University*

The Relationship between Teachers' Preferred Explanations and the Nature of the Science Content — Jeffersonian

(A Learning: Students' Conceptions & Conceptual Change: Symposium)

Presider: David F. Treagust, *Curtin University of Technology, Australia*

Participants:

David F. Treagust, Louise Tyson, Grady Venville, Allan Harrison, *Curtin University of Technology, Australia*; Carol Boulter, John Gilbert, *University of Reading, England*

Access of NARST'S World Wide Web Internet Server and the Development of Similar Servers — Midnight Special

(G Educational Technology: Novel Format)

Presider: William Holliday, *University of Maryland*

Presenter:

Joseph Peters, *University of West Florida*

Expert Science Teaching: Novice Through Expert Year II — Missouri Pacific

(C Teaching: Paper Set Organized by Proposer)

Presider: Judith A. Burry-Stock, *University of Alabama*

Discussant: Robert Yager, *University of Iowa*

Expert Science Teaching: Expert Science Teaching Educational Evaluation Model (ESTEEM) Implementation

Judith A. Burry-Stock, *University of Alabama*

Expertise in Preservice Science Education: An Innovative Approach to Training Elementary Science Educators Year II

Gail Shroyer, Emmett L. Wright, *Kansas State University*

Expertise in Preservice Science Teaching Across 10 National Sites: The Salish Project Year II

Judy Vopava, *University of Iowa*

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Expertise in Inservice Science Education: Relationship between Science Teachers' Beliefs and Practice
Gary Varrella, *University of Iowa*

On Becoming A Constructivist Teacher
Rosalina Hairston, *University of Southern Mississippi*

Revisioning Science Teaching and Learning through "Multicultural" Science and Feminist Frameworks

New York Central

(H History, Philosophy and Epistemology: Symposium)
Presider: Sharon Nichols, *University of Texas at Austin*

Revisioning Science Teaching and Learning
Sharon Nichols, *University of Texas at Austin*; Deborah Tippins, *University of Georgia*; Leslie Parker, *Curtin University of Technology, Australia*; Sue Stocklmayer, *Australian National University*; Catherine Milne, *Curtin University of Technology, Australia*; Anita Roychoudhury, *Miami University of Ohio*

Action Research in Science Education

Wabash Cannonball

(C Teaching: Round Table)
Presider: Mark Latz, *Oregon State University*

Action Research and Learning Theories: Reflective Tools for Professional Development
Angelo Collins, *Vanderbilt University*; Samuel A. Spiegel, *Florida State University*

Reflections from a Year of Teaching in an Urban High School
Lee Meadows, *University of Alabama at Birmingham*

Action Research in Chemistry Classrooms: A Group Approach
Dorothy L. Gabel, *Indiana University*; Diane M. Bunce, *Catholic University*

8:30 PM — 10:00 PM Reception and Poster Session Sunday, March 31, 1996

Regency A, B, C

(A Learning: Students' Conceptions & Conceptual Change)

Development Of A Two Tier Test To Examine Students' Understanding Of Chemical Equilibrium
Louise Tyson, David Treagust, *Curtin University of Technology, Australia*; R. Bucat, *University of Western Australia*

Science Students' Modeling Abilities and Mental Images of Atoms and Molecules
Allan G. Harrison, *Curtin University of Technology, Australia*

Teachers' Conceptions of Wasps as Revealed by Their Drawings
Thomas R. Koballa, Jr., *University of Georgia*; Eric J. Pyle, *West Virginia University*

A Pre-Lab Guide for General Chemistry: Improving Student Understanding of Chemical Concepts and Processes
Maria K. Kirk, *College of Notre Dame of Maryland*; John W. Layman, William S. Harwood, *University of Maryland*

Effect of the Learning Cycle on Student Achievement and Attitudes in Elementary Natural Science
Iris T. Huang, Hui-lin Huang, *National Kaohsiung Normal University, Republic of China*

Attitudinal and Cognitive Dimensions of Middle Grades Students Participating in an Open-Ended Inquiry Laboratory
Lynda R. Flage, *University of Georgia*

(E Curriculum, Evaluation and Assessment)

The Development of a Wetland Attitude Defensibility Inventory
Jeff A. Thomas, Rosalina Hairston, *University of Southern Mississippi*

Evidence of Change in Student Achievement: An Analysis of State Wide Systemic Reform Initiatives
Alberto J. Rodriguez, *University of Wisconsin-Madison*

The Effects of Using the Learning Cycle to Teach Physiology to Elementary Students in Large and Small School Districts
William D. Simpson, Ann M. Cavallo, *University of Oklahoma*

Michigan High School Proficiency Examination
Patricia L. Buczynski, *Michigan Department of Education*; Burton E. Voss, *University of Michigan*

Evaluating Industry-Produced Curriculum Materials: An Analysis of the Exxon Energy Cube
Michael J. Padilla, Deborah J. Tippins, Katherine Wieseman, *University of Georgia*

The Development, Implementation and Evaluation of a Curricular Unit on "Interaction of Light and Matter".

Jacob Ronkin, Avi Hofstein, Ruth Ben-Zvi, Ron Naaman, *Weizmann Institute of Science, Israel*

Lessons From Weyerhaeuser — Developing a Curriculum through Collaboration

Shireen J. M. Desouza, *Georgia Southwestern University*

(G Educational Technology)

The "Scientists in Action" Project: Initial Field Studies and Design Revisions

Robert D. Sherwood, *Vanderbilt University*

World Wide Web and Traditional Classrooms: An Update of *Tech Tools* and Improving the Use and Access for the Purposes of Improving Science Instruction

Randy Yerrick, *East Carolina University*; Harol Hoffman, Jerry Meisner, *University of North Carolina at Greensboro*

MONDAY April 1, 1996

Program Overview

Session	Room	Time
Committee Meetings		7:00 am - 8:30 am
STRAND SESSIONS	rooms as listed in schedule	8:30 am - 10:00 am
STRAND SESSIONS	rooms as listed in schedule	10:30 am - 12:00 pm
Lunch (on your own)		12:00 pm - 1:00 pm
STRAND SESSIONS	rooms as listed in schedule	1:00 pm -2:30 pm
STRAND SESSIONS	rooms as listed in schedule	2:45 pm -3:45 pm
STRAND SESSIONS	rooms as listed in schedule	4:00 pm - 5:30 pm
Invited Session for Past Presidents, Distinguished Contributions Awardees and Executive Secretaries (Hosted by NARST Board & Sponsored by Kluwer Academic Publishers)	NARST PRESIDENT'S SUITE	4:00 pm - 5:30 pm
JRST Editorial Board Meeting and Dinner	ILLINIOS CENTRAL	5:30 pm - 8:30 pm

MONDAY April 1, 1996

Strand Highlights

Sponsor	Session	Time & Room
STRAND A	*Improving Teaching and Learning in Science Education* David F. Treagust, Reinders Duit, Hans Niedderer, James Gallagher, Vincent N. Lunetta	4:00 pm – 5:30 pm GRAND F
STRAND B	*Textbook without Paper – Teaching in Cyberspace* George Johnson	1:00 pm – 2:30 pm REGENCY C
STRAND C	*Interpretive Autobiography as a Method to Investigate Teacher Learning* Nancy T. Davis, John Schaller, Maggie Helly, Mary M. Cozean Alexander	4:00 pm – 5:30 pm MISSOURI PACIFIC
STRAND D	*Science for All Students: Challenges for the Next Quarter Century* James Gallagher	2:45 pm – 3:45 pm GRAND E
STRAND E	*Does School Science Make a Difference?* David P. Butts	2:45 pm – 3:45 pm REGENCY C
STRAND F	*Mirror, Mirror on the Wall, Who is the Fairest One of All?* Karen Meyers, Sharon Parsons	2:45 pm – 3:45 pm GRAND A
STRAND H	*Reaching Consensus on the Nature of Science: Implications for the Classroom* Cathleen Loving, Norman G. Lederman, William W. Cobern, Catherine L. Cummins, Sherry S. Demastes, John Trowbridge, Ronald G. Good, Michael R. Matthews, Yvonne J. Meichtry, James H. Wandersee	10:30 am – 12:00 pm NEW YORK CENTRAL
STRAND J	*Environmental Education* Michael Kamen, Annette Gough, J. William Hug, Lois M. Campbell, Randy Cromwell, Noel Gough	8:30 am – 10:00 am BURLINGTON ROUTE

7:00 AM — 8:30 AM Committee Meetings Monday, April 1, 1996

Equity Committee **Colorado Eagle**
Presider: Sandra Abell, *Purdue University*

Outstanding Doctoral Dissertation Award Committee **Dixie Flyer**
Presider: Russell Yeany, *University of Georgia*

Outstanding Paper Award Committee **Frisco**
Presider: Joe Krajcik, *University of Michigan*

JRST Award Committee **Jeffersonian**
Presider: Nancy Brickhouse, *University of Delaware*

Distinguished Contributions to Science Education through Research Award Committee **Meteor**
Presider: David Treagust, *Curtin University of Technology, Australia*

Early Career Research Award Committee **Midnight Special**
Presider: Robert Sherwood, *Vanderbilt University*

Outstanding Master's Thesis Award Committee **Texas Special**
Presider: Angelo Collins, *Vanderbilt University*

Policy Advisory Committee **Zephyr Rocket**
Presider: Dorothy Gabel, *Indiana University*

8:30 AM — 10:00 AM Strand Sessions Monday, April 1, 1996

Environmental Education **Burlington Route**
(J Informal Learning: Paper Set Organized by Proposer)
Presider: Frank Crawley, *East Carolina University*
Discussant: Bonnie Shapiro, *University of Calgary*

Developing a Present Absence: A Feminist Perspective in Environmental Education Research and Practice
Annette Gough, *Deakin University*

Prospective Science Teachers' Understanding of the Development of a Sense of Place Through an Environmental Science Methods Course
J. William Hug, Lois M. Campbell, *Pennsylvania State University*

An Environmental Education Field Trip Integrated into an Elementary Science Methods Class: Meaning of the Emerging Teachers
Michael Kamen , Randy Cromwell, *Auburn University*

Rethinking the Subject: A Poststructuralist Analysis of the Construction of Human Agency in Environmental Education
Noel Gough, *Deakin University*

Computers as Educational Tools **Frisco**
(G Educational Technology: Paper Set Organized by Proposer)
Presider: Rebecca Denning, *Ohio State University*
Discussant: Stanley Helgeson, *Ohio State University*

Advanced Technologies in a Project-Based Classroom: A Case Study
Anthony Petrosino, Bill Rodriquez, Sean Brophy, *Vanderbilt University*

MARS: A Computer-Supported Middle School Science Curriculum to Foster Model Based Analytical Reasoning
Kalyami Raghavan, Robert Glaser, Mary Sartoris, *University of Pittsburgh*

Instruction in Scientific Inquiry Skills
Kurt Steuck, *United States Air Force*

Computer Tools to Facilitate Problem Understanding of Video Based Anchors
Sean P. Brophy, *Vanderbilt University*

Influence of Language and Culture on Science Learning

Grand A

(F Cultural, Social and Gender Issues: Paper Set Grouped by Committee)
Presider: Sharon Nichols, *University of Texas at Austin*

Language and Culture in the U.S. Public Education System: Emergent Cultural and Political Issues
Aldrin E. Sweeney, Alejandro Jose Gallard, *Florida State University*

Developing a New Language to Create New Visions for the Learning of Science and Limited English Proficient Students
Alejandro Jose Gallard, *Florida State University*

Interactional Patterns of Linguistically Diverse Students in Science Performance
Okhee Lee, Sandra H. Fradd, *University of Miami*

Models that Explain Science Learning

Grand B

(B Learning: Classroom Contexts and Learner Characteristics: Paper Set Grouped by Committee)
Presider: J. Steve Oliver, *University of Georgia*

A Collaborative Cross-Cultural Look at the Effects of Television Use and the Structure of Everyday Experiences and Control Beliefs on Science Achievement and Science Problem Solving Among Fourth Graders in Germany and the USA
Helmut Geiser, *University of Kiel, Germany*; Robert H. Evans, *Wake Forest University*; Jurgen Baumert, *University of Kiel, Germany*

Testing and Building Causal Models for Meaningful Understanding in the Learning Of Genetics Concepts
Ann M.L. Cavallo, Raymond B. Miller, *University of Oklahoma*; Marcy A. Blackburn, *Cameron University*

Relationships Among Prior Conceptual Knowledge, Metacognitive Awareness, Metacognitive Self-Management, Cognitive Style, Perception-Judgement Style, Attitude Toward School Science, Self-Regulation and Science Achievement in Gr. 6-7 Students
Larry D. Yore, *University of Victoria*; Trudy Holden, *Victoria, BC*

Constructivist Teaching Approaches in Science

Grand C

(D Teacher Education: Paper Set Grouped by Committee)
Presider: William W. Cobern, *Arizona State University West*

Two Case Studies of Preservice Teachers' Beliefs Concerning Constructivist Teaching Practices in the Science Classroom
Jodi J. Haney, Julia M. McArthur, *Bowling Green State University*

Impacts of a Constructivistic-Inquiry Approach to Extended Classroom Activities on Secondary Level Science Teachers' Attitudes About Inquiry-Based Science
Michael Marlow, *University of Colorado at Denver*

Anxiety About Constructivist Science Teaching: A Longitudinal Study
Shu-mey Yu, *National Taichung Teachers College, Republic of China*

Introducing Philosophy of Science Through an Activity for In-Service Teachers to Experience Social Constructing of Knowledge
Wen-Hua Chang, *National Changhua University of Education, Republic of China*

Seeking More Significant Learning Outcomes From Laboratory Experiences in Science Instruction Grades 7-14

Grand D

(D Teacher Education: Paper Set Organized by Proposer)
Presider: Frank X. Sutman, *Temple University*
Discussant: Richard W. Moore, *Miami University of Ohio*

Meta-Analyses of Learning from Laboratory Based Experiences (9-14)
Joseph S. Schmuckler, *Temple University*; Susan Rubin, *Episcopal Academy*; Mulian Zhou, *South Philadelphia High School*

Analyses of Teaching Behaviors During Laboratory Based Instruction (9-14)
Frank X. Sutman, *Temple University*; Alexandra Hilosky, *Harcum College*; Wang Mei, *Walter Johnson High School*

Impact of Modeled Teacher Enhancement on Instructional Behaviors (7-12)
Holly Priestley, William J. Priestley, *Morrisville High School*

Studies of Classroom Learning Environments

Grand E

(B Learning: Classroom Contexts and Learner Characteristics: Paper Set Grouped by Committee)

Presider: Patricia Simmons, *University of Georgia*

The Learning Environment in a Physics Classroom

Jim Watters, Keith B. Lucas, *Queensland University of Technology, Australia*

Sex and Race Differences in 9th Grade Science Students' Perceptions of Their Learning Environments

Mark A. Minger, Frances Lawrenz, Douglas Huffman, Kirsten Bancroft, *University of Minnesota*

Factors Involved in Science Classroom Climate: A Case Study of an Elementary School Science Teacher

Su-Shiang Wang, *National Taipei Teachers College, Republic of China*; Ching-Yang Chou, *National Kaoshiung University of Education, Republic of China*; Chao-Ti Hsiung, *National Taipei Teachers College, Republic of China*

Use of Classroom Environment Instruments in Monitoring Urban Systemic Reform

Michael Dryden, *Dallas Independent School District*; Barrry J. Fraser, *Curtin University of Technology, Australia*

Innovative Programs Designed to Bring About Teacher Change and Science Education Reform

Illinois Central

(D Teacher Education: Paper Set Grouped by Committee)

Presider: Kathleen Roth, *Michigan State University*

A Naturalistic Study of Participants in an Innovative Graduate Program for Mathematics and Science Teachers

Merton L. Glass, *Cumberland College*; Barbara S. Spector, *University of South Florida*

Results of a Longitudinal Study of an Experimental Teacher Education Program in Elementary Science

Patricia A. McClurg, Joseph Stepans, Ronald Beiswenger, *University of Wyoming*

Restructuring Elementary Science Instruction for Female, Rural, and Minority Students

Barbara Foulks, Carolyn Butcher Dickman, *Radford University*

On-Site Inquiry: Real Hope for Science Education Reform

Judith Johnson, *University of Central Florida*

Model Inservice Teacher Education Programs

Jeffersonian

(C Teaching: Paper Set Grouped by Committee)

Presider: Gail Shroyer, *Kansas State University*

The Description of Leadership Models for Professional Development in Science and Mathematics

Josephine D. Wallace, Catherine R. Nesbit, *University of North Carolina at Charlotte;* Anne Courtney Miller, *University of North Carolina at Greensboro*

Teachers As Leaders In Staff Development: Implications For Classroom Practice

Helen M. Parke, *East Carolina University*

Exploring Issues of Success: A Consideration of Some of the Outcomes of the Nigerian Integrated Science Teacher Education Project

Sally Johnson, Christine Harrison, *King's College, London, England*

A Model for Integrating Environmental Science with the K-12 School Curriculum Using Computational Technologies through Computational Training for Teacher Enhancement, Action, and Motivation

Helen M. Parke, Charles R. Coble, *East Carolina University*

Approaches To The Provision Of Classroom Based Support For Teachers

Dianne Raubenheimer, Nkosinathi Mhlongo, Stephen Harvey, *Primary Science Programme, South Africa*

An Analysis of Elementary Teachers' Needs in Math and Science

Midnight Special

(E Curriculum, Evaluation, and Assessment: Novel Format)

Presider: Lilia Reyes-Herrera, *Florida State University*

Presenter:

Chris Muire, *Florida State University*

Painting a Picture of Middle School

Missouri Pacific

(C Teaching: Paper Set Organized by Proposer)

Presider: Dana Riley, *Miami University of Ohio*

Discussant: Joanne Tims, *Curtin University of Technology, Australia*

Research Demanded by Systemic Reform: Multi-Level Analyses of Interpretive Data

Jane Butler Kahle, *Miami University of Ohio*; Ken Tobin, *Florida State University*

The Landscape Instrument Set: Painting the Panorama of the Landscape
Steve Rogg, *Miami University of Ohio*; Bill Boone, *Indiana University*; Arta Damnjanovic, *Miami University of Ohio*

Close Up View with NUD IST
Anita Roychoudhury, *Miami University of Ohio*

Blending the Panorama with the Close Up View: Practical Procedures and Examples
G. Nathan Carnes, Arta Damnjanovic, *Miami University of Ohio*

Teaching and Learning About the Nature of Science — New York Central

(H History, Philosophy and Epistemology: Paper Set Organized by Proposer)
Presider: Kathryn Scantlebury, *University of Delaware*
Discussant: Sandra Abell, *Purdue University*

Fourth Graders Explore the Relationship Between Science and Technology: Identity Construction Traverses the Scientific Landscape
Julie Schmidt, *University of Deleware*

A Teacher's Practices and Students' Understanding of Science: The Case of a Seventh Grade Classroom
Zoubeida Dagher, *University of Delaware*

Dilemmas Created by Infusing the Nature of Science into Earth Science Curricula
Michael J. Smith, *University of Delaware*

The Problem of Dogmatism in Science Education
Nancy W. Brickhouse, William J. Letts, IV, Aletha Ramseur, Michael J. Smith, *University of Deleware*

Initiating and Maintaining Continuous Assessment — Regency A

(E Curriculum, Evaluation, and Assessment: Symposium)
Presider and Discussant: Glen Aikenhead, *University of Saskatchewan*
Participants:
James J. Gallagher, Joyce Parker, *Michigan State University*; David Sandys, *Toledo Junior High School*; Dorcas Gonzalez-Lantz, *Otto Middle School*

Surfing Science Curriculum Reform: On the Crest of a Wave or Caught in the Wave Break? — Regency B

(E Curriculum, Evaluation, and Assessment: Symposium)
Presider: Julie Gess-Newsome, *University of Utah*
Participants:
Katherine Wieseman, Deborah J. Tippins, Michael J. Padilla, *University of Georgia*; JoEllen Roseman, *American Association for the Advancement of Science*; Sharon Nichols, *University of Texas at Austin*; Susan Loucks-Horsley, *The Network, Inc.*

Factors Affecting the Teaching Success of New Science Teachers — Regency C

(D Teacher Education: Paper Set Organized by Proposer)
Presider: Robert E. Yager, *University of Iowa*
Discussant: Senta Raizen, *The Network, Inc.*

The Salish I Research Project
Patricia Bourexis, *The Study Group, Inc*

Comparing Teacher and Student Perceptions of the Future of Science
Robert K. James, Kristin Hamm, Kay Labuda, *Texas A & M University*

Curriculum Change
Sheryl McGlamery, Douglas MacIsaac, *University of Northern Colorado*

Comparison of New Secondary Science Teachers' Practices and their Students' Perceptions of Teaching as Recorded Using the Secondary Teaching Analysis Matrix and the Constructivist Learning Environment Survey
James Gallagher, Joyce Parker, Donald Duggan-Haas, Qasim AlShannag, *Michigan State University*

A Preliminary Interpretation Report from the University of South Florida of Teacher Behaviors and Student Perceptions as Revealed by the "Secondary Science Teacher Matrix" and Student Scores on the "Constructivist Learning Environment Survey"
Barbara Spector, Tom LaPorta, *University of South Florida*

Linking Student Outcomes, Teaching Performance, and Features of Teacher Education Programs
Patricia Simmons, *University of Georgia*

Outcomes Associated with Science Teacher Development Programs

Wabash Cannonball

(D Teacher Education: Round Table)

Presider: Charles McFadden, *University of New Brunswick*

Understanding STS as a Curriculum Framework for Pre-College Science Instruction: A Longitudinal Study of Elementary and Secondary Science Teachers

Richard R. Powell, *Texas Tech University*; Michael Robinson, *University of Nevada, Reno*; Christine Purkiss, *Texas Tech University*; Kimberly Perry, *Hutchinson Junior High School*

A Collaborative Science/Education Teacher Staff Development Program

Teresa Arambula Greenfield, Arnold Feldman, *University of Hawaii*

Helping Teachers To Be Novice Scientists: Does it Help Them to Put Their Students in the Same Position?

Herman G. Weller, Mary D. Bird, *University of Maine*

An Ecofeminist Perspective of a Case Study Involving the Status of Inservice Teacher Staff Development for Environmental Education in Texas

E. Diane Birsner, *University of Texas at Austin*

10:30 AM — 12:00 PM Strand Sessions Monday, April 1, 1996

Sociocultural Perspectives on Science Teaching and Learning

Burlington Route

(H History, Philosophy and Epistemology: Paper Set Grouped by Committee)

Presider: Obed Norman, *Washington State University*

A World View of Education: Through the Eyes of Ethnicity and Culture

Mary M. Atwater, Denise Crockett, *University of Georgia*

Philosophically Correct Science Stories

Catherine Milne, *Curtin University of Technology, Australia*

Toward a Cross-Cultural Perspective on Western Students Learning Western Science: Border Crossings

Glen S. Aikenhead, *University of Saskatchewan*

Two Cultures of Teacher Preparation: Effects on Teacher Candidates' "World View"

Penny L. Hammrich, *Temple University*; Kerri L. Armstrong, *Philadelphia, PA*

Uses of Technology in Elementary School Science

Frisco

(G Educational Technology: Paper Set Grouped by Committee)

Presider: Tina Jarvis, *Leicester University, England*

Effects of the Use of a Science Interactive Videodisc on the Prediction Ability of Kindergarten Students

Edward L. Shaw, Jr., Robert L. Doan, Richard L. Daughenbaugh, Deborah Green, *University of South Alabama*

Questions Asked by Elementary Science Teachers Using Moving and Still Frames of Videodisc Instruction

Coralee S. Smith, Lloyd H. Barrow, *University of Missouri-Columbia*

Microcomputer-Based Laboratories in Elementary School Science

Pamela L. Farr, *North Thurston School District*

Questions and Issues Raised by Teaching Science Using a Thematic Approach in Elementary Teacher Education Courses

Grand A

(F Cultural, Social and Gender Issues: Symposium)

Presider: Deborah C. Smith, *Michigan State University*

Discussant: Marcia Fetters, *University of North Carolina-Charlotte*

Participants:

Christopher Burke, B. C. Bruce, M.D. Osborne, Trudy Morritz, Anna Li, *University of Illinois at Urbana-Champaign*

Chemistry Learning Experiences at the Secondary and Collegiate Levels

Grand B

(B Learning: Classroom Contexts and Learner Characteristics: Paper Set Grouped by Committee)

Presider: Craig Bowen, *University of Washington*

Interest in Chemistry: How to Promote Life-Long Attention to Chemistry Related Problems

Wolfgang K. Graeber, *University of Kiel, Germany*

A Qualitative Analysis of the Chemistry Graduate Student Experience

Margaret A. Workman, George M. Bodner, *Purdue University*

The Mole Environment Studyware: Principles, Design and Implementation

Yehudit J. Dori, Maira Hemeiri, *Technion -Israel Institute of Technology, Israel*

A Unique Chemistry Learning Environment: Multimedia Use In A Chemcom Classroom
Maureen M. McMahon, *University of California, Davis*; William S. Harwood, *University of Maryland*

Student Construction of Physics Knowledge — Grand D

(B Learning: Classroom Contexts and Learner Characteristics: Paper Set Grouped by Committee)
Presider: Michael T. Svec, *Rockhurst College*

The Construction of Knowledge in Traditional High School Physics Laboratories: A Phenomenological Analysis
Wolff-Michael Roth, *Simon Fraser University*; Cam McRobbie, Keith Lucas, *Queensland University of Technology, Australia*; Sylvie Boutonné, *Simon Fraser University*

Experimental Investigation of Student Understanding in Physics: A Case Study
Monica Ferguson-Hessler, *Eindhoven University of Technology, The Netherlands*

Physics Concept Construction through Experiment, Drawing, Discussion, and Dialogue
Rudy F. Sirochman, *Indiana University*

An Analysis of the Role of Language in Science Learning: Issues Related to Learning Science in a Second Language — Grand E

(B Learning: Classroom Contexts and Learner Characteristics: Symposium)
Presider: Michael Kamen, *Auburn University*
Participants:
Michael Kamen, *Auburn University*; Stephen Marble, *University of Hawaii*; Larry Flick, *Oregon State University*; Nancy Davis, *Florida State University*; Wolff-Michael Roth, *Simon Fraser University*; Marissa Rollnick, *University of Witersrand, South Africa*; Kathie Black, *University of Victoria*; Thomas Destino, *University of California, Riverside*

Reflective Practice in Science Teaching and Learning — Illinois Central

(D Teacher Education: Paper Set Grouped by Committee)
Presider: Hedy Moscovici, *Western Washington University*

The Power of a Partner: Using Collaborative Discussion to Build Understandings of Constructivism as a Referent for Middle Grades Science and Mathematics Teaching
Carolyn W. Keys, Priscilla S. Golley, *Georgia State University*

Case Studies on Teachers' Reflective Practice within the Developmental Research Project PING
Peter Reinhold, *University of Kiel, Germany*

Preservice Elementary Teachers' Thinking about Science Teaching: Experiences, Frames, and Inconsistencies
Lynn A. Bryan, Sandra K. Abell, Maria A. Anderson, *Purdue University*

Elementary Teachers' Investigating Their Own Practice: The Evolution of Science Study Groups in an Urban School District
John Settlage, *Cleveland State University*

Research and Research Methods by the Committee for Individual Networking — Jeffersonian

(D Teacher Education: Paper Set Organized by Proposer)
Presider: Merton Glass, *Cumberland College*

Science Education on the Texas/Mexico Border: Science Teaching Practices
Katherine I. Norman, *University of Texas at Brownsville*

The Process of Changing Science Teaching Paradigms among College Science Faculty: A Case Study of Collaboration at a Small College
B. Patricia Patterson, *Wesley College*

A Longitudinal Study of Secondary Science Teachers: Teachers' Voices on the Relationships Among Knowledge Domains
Meta van Sickle, *University of Charleston*; Carolyn Dickman, *Radford University*; Margaret Bogan, *University of Jacksonville*

Teachers' Beliefs About STS-Oriented Issues — Missouri Pacific

(C Teaching: Paper Set Grouped by Committee)
Presider: Lynda Flage, *University of Georgia*

Beliefs of Science Teachers Towards the Implementation of Controversial Social/Technological Issues as Part of the Extant Curriculum
Jon E. Pedersen, *East Carolina University*; Kristy Spivey, *University of Arkansas*

Raising Teachers' Sights: Teacher Change in a School Community Environmental Education Project
James J. Gallagher, Christopher Wheeler, Maureen McDonough, *Michigan State University*; Benjalug Soopokakit, *Ministry of Education, Thailand*

The Examination and Prediction of Science Teachers' Intentions to Teach about HIV/AIDS
Weir-Sen Lin, *Taiwan, Republic of China*; John T. Wilson, *University of Iowa*

Teachers' Beliefs and Their Intent to Implement Science/Technology/Society (STS) in the Classroom
Andrew T. Lumpe, *University of Toledo*; Jodi J. Haney, *Bowling Green State University*; Charlene M. Czerniak, *University of Toledo*

Reaching Consensus on the Nature of Science: Implications for the Classroom

New York Central

(H History, Philosophy and Epistemology: Invited Session)
Presider: Cathleen C. Loving, *Texas A&M University*
Discussant: Norman G. Lederman, *Oregon State University*
Participants:
Cathleen C. Loving, *Texas A&M University*; Norman G. Lederman, *Oregon State University*; William W. Cobern, *Arizona State University West*; Catherine L. Cummins, *Louisiana State University*; Sherry S. Demastes, *University of Utah*; John Trowbridge, *Southeastern Louisiana University*; Ronald G. Good , *Louisiana State University* ; Michael R. Matthews, *University of New South Wales, Australia*; Yvonne J. Meichtry, *Cincinnati, OH*; James H. Wandersee, *Louisiana State University*

Instruments to Measure Science-Related Attitudes and Perceptions

Regency A

(B Learning: Classroom Contexts and Learner Characteristics: Paper Set Grouped by Committee)
Presider: J. Steve Oliver, *University of Georgia*

Multicultural Learning Environments: Influence of Culture on Science Learning
Bruce G. Waldrip, Geoff J. Giddings, *Curtin University of Technology, Australia*

Views About Sciences Survey
Ibrahim Halloun, David Hestenes, *Arizona State University*

Development and Validation of an Attitudes Toward Graphing Questionnaire for Nonscience Majors
Donna M. Plummer, Robin Hurst-March, *University of Missouri-Columbia*

Development of Personal and Class Forms of a Science Classroom Environment Questionnaire
Barry J. Fraser, *Curtin University of Technology, Australia*; Campbell J. McRobbie, *Queensland University of Technology, Australia*; Darrell L. Fisher, *Curtin University of Technology, Australia*

Application of PACE: A Participant Constructed Evaluation Model

Regency B

(E Curriculum, Evaluation, and Assessment: Paper Set Organized by Proposer)
Presider: Sharon Nichols, *University of Texas at Austin*
Discussant: Mary Louise Bellamy, *National Association of Biology Teachers*

Does Participation in an Undergraduate Methods Course Make a Difference?
Thomas Elliott, Thomas Koballa, Jr., Joseph Riley, David Butts, *University of Georgia*

Does Science Olympiad Make a Difference?
Milton Stobler, *Georgia Institute of Technology*; David Butts, *University of Georgia*

Does Participation in a District-Wide Science Framework Make a Difference?
David Cooper, Brenda Waldon, *Clayton County Schools*; David Butts, *University of Georgia*

Does a Science Leadership Program Make a Difference?
Joseph P. Riley, Lena Lane, *University of Georgia*

Scientfic Literacy: Myth or Possibility

Regency C

(H History, Philosophy and Epistemology: Symposium)
Presider: William C. Kyle, Jr., *Purdue University*
Participants:
Angelo Collins, *Vanderbilt University*; Ronald G. Good, *Louisiana State University*; William C. Kyle, Jr., *Purdue University*

Science Knowledge Construction and Problem Solving **Wabash Cannonball**

(G Educational Technology: Round Table)

Presider: Susan Westbrook, *North Carolina State University*

Relating Differential Strategy Use of Hypermedia to the Detection of Exceptional Achievement in Learning Science

Sharolyn J. Belzer, *Idaho State University*; George Estabrook, *University of Michigan*

Progression In Genetics Conceptions: A Case Study of Knowledge Construction in the Classroom

Hui-Ju Huang, *University of Illinois*

Influence of Algorithms Over Various Task Contexts

Julia Anne Misiak, *Centenary College*; Rosie Allen-Noble, *Medical College of Georgia*; Marilyn F. Hughes, *Montclair State University*

Teaching from a Constructivist Paradigm: A Way of Knowing and Learning or a Case of "Pedagogical Tricks?"

M. Gertrude Hennessey, *St. Ann's School*; Michael E. Beeth, *Ohio State University*; Aletta Zietsman, *University of Witwatersrand, South Africa*

12:00 PM — 1:00 PM Lunch Monday, April 1, 1996

Lunch on your own

1:00 PM — 2:30 PM Strand Sessions Monday, April 1, 1996

Issues of Socially Enlightened Science and Technology Education **Burlington Route**

(D Teacher Education: Paper Set Grouped by Committee)

Presider: John Wiggins, *Georgia Institute of Technology*

Preservice Secondary Science Teachers' Orientations Toward Science-Technology-Society (STS) Instruction

Lawrence C. Scharmann, Gail Shroyer, *Kansas State University*; Cherin Lee, *University of Northern Iowa*

Teacher Thinking about Issues-Use: Implications for Reform?

Carol Landis, *Ohio State University*

Using Technology to Reform Science Teaching and Learning **Frisco**

(G Educational Technology: Paper Set Grouped by Committee)

Presider: David Jackson, *University of Georgia*

Teachers, Science Education Reform, and Innovative Technology: Case Stories From the Kids As Global Scientists Project

Nancy Butler Songer, *University of Colorado*

Use of Data Modeling in Designing Interactive Chemistry Laboratory Software

Nancy Kerner, Carl Berger, Charles Dershimer, James Penner, *University of Michigan*

Interactive Video Technology and Hands-On Science

William J. Boone, *Indiana University*

An Investigation on the Effects of Using Interactive Digital Video in a Physics Classroom on Student Learning and Attitudes

Lawrence T. Escalada, Dean A. Zollman, *Kansas State University*

An Equity Blueprint for Project 2061 Science Education Reform **Grand A**

(F Cultural, Social and Gender Issues: Symposium)

Presider: Sharon Lynch, *George Washington University*

Discussant: Jo Ellen Roseman, *American Association for the Advancement of Science*

Participants:

Sharon Lynch, *George Washington University*; Mary Atwater, *University of Georgia*; Okhee Lee, *University of Miami*; Jo Ellen Roseman, *American Association for the Advancement of Science*

Images and Perceptions of Scientists, Science Teachers, and Science **Grand B**

(C Teaching: Paper Set Grouped by Committee)

Presider: David Deru, *University of Georgia*

Customizing the Draw-a-Scientist Test to Analyze the Effect That Teachers Have on Their Students' Perceptions of and Attitudes Toward Science

Juanita Jo Matkins, J. Preston Prather, *University of Virginia*

Analyzing Students' Perceptions of Science as Inquiry: The Development of the "Scientists Doing Science (SDS)" Instrument and Assessment Rubric
Ann Haley-Oliphant, Julie A. Dargart, *Miami University of Ohio*

A Study Of the Images of the Scientist for Elementary School Children
Chorng-Jee Guo, Chia-Ling Chiang, *National Changhua University of Education, Republic of China*

A Science Teacher's Self-Selected Metaphors: How Do Students' Metaphorical Perceptions Match Up?
Donna K. Dorough, Thomas M. Dana, *Pennsylvania State University*

Teachers in Partnership for Change: Feasibility Studies — Grand C

(D Teacher Education: Paper Set Organized by Proposer)
Presider: Sandra Abell, *Purdue University*

A Longitudinal Study of an Action Research Program: Implications for Educational Innovation and Professional Development
Donna F. Berlin, Arthur L. White, *Ohio State University*

Enhancing the Professional Status of Teachers Through Partnership
Michael H. Klapper, *Ohio State University*; Phillip A. Heath, *Ohio State University at Lima*

Defining a Professional Environment for Teaching
Arthur L. White, Donna F. Berlin, Michael H. Klapper, *Ohio State University*

College Students' Understandings of Chemical Concepts — Grand D

(A Learning: Students' Conceptions & Conceptual Change: Paper Set Grouped by Committee)
Presider: Joseph Krajcik, *University of Michigan*

College Chemistry Students: An Examination of Their Knowledge of Fundamental Concepts and Uses of Argument
Patricia Schroeder, *Johnson County Community College*; John Staver, *Kansas State University*

Understanding Alternative Conceptions In Chemistry: A Neo-Piagetian Explanatory Model
Luisa Rojas de Astudillo, Mansoor Niaz, *Universidad de Oriente, Venezuela*

Action Research in Undergraduate Chemistry: Results from Project REMODEL
Mary B. Nakhleh, Kristin Lowrey, *Purdue University*

Molecular Metaphor for Learning
Penny J. Gilmer, Scott Engel, *Florida State University*

Influence of Reading and Writing on Science Learning — Grand E

(B Learning: Classroom Contexts and Learner Characteristics: Paper Set Grouped by Committee)
Presider: Zoubeida Dagher, *University of Delaware*

Effect of Incorporating Reflective Writing into the Teaching of Evolution to a High School Biology Class
Valerie Keeling Olness, *Augustana College*; Fred N. Finley, *University of Minnesota*

Writing In/Forms Science and Science Learning
Gaell Hildebrand, *University of Melbourne, Australia*

The Effect of Talk and Writing, Alone and Combined, on Learning in Science: An Exploratory Study
Leonard P. Rivard, Stanley B. Straw, *Collège Universitaire de Saint-Boniface*

More Than Just Science! A Science Teacher's Journey into the Realm of Reading and Writing
William G. Holliday, *University of Maryland*; Maureen M. McMahon, *University of California-Davis*; Christine Kelly, *University of Maryland*; Gary Spinella, *Rosa Parks Middle School*; Grace Benigno, Donna Obermeier, *University of Maryland*

Issues of Gender and Ethnicity in the Science Classroom — Grand F

(F Cultural, Social and Gender Issues: Paper Set Grouped by Committee)
Presider: Elizabeth Doster, *University of Georgia*

Girls and Computing: Gendered Experiences in a Non-Traditional Science Classroom
Julie L. Yates, Elizabeth A. Finkel, *University of Michigan*

Gender, Enthnicity and Science
Teresa Arambula Greenfield, *University of Hawaii*

The Construction of Gender in Single-Sex and Mixed-Sex Classrooms
Léonie J. Rennie, Lesley H. Parker, *Curtin University of Technology, Australia*

Two Different Worlds: Girls' and Boys' Perspectives and Preferences of the Science Classroom
Kathryn Scantlebury, *University of Delaware*

Teachers Use of Science As How We Know **Illinois Central**

(D Teacher Education: Paper Set Organized by Proposer)

Presider: David Treagust, *Curtin University of Technology, Australia*

An Historical Examination of Science Teachers' Use of Science as a Way of Knowing as an Instructional Organizer

B. Kim Nichols, *University of Georgia*

A Framework for Teaching "How Can You Know?"

J. Steve Oliver, *University of Georgia*

An Investigation of the Use of an Innovative Instructional Organizer for Teaching Science: "How Can You Know?"

Renna B. Calvert, *University of Georgia*

"How Can You Know?" In the High School Laboratory: An Application of the Shoestring Biology Labs

Mary Louise Bellamy, *National Association of Biology Teachers*

Conceptual Change in Science Education Research **Jeffersonian**

(B Learning: Classroom Contexts and Learner Characteristics: Paper Set Grouped by Committee)

Presider: Peter Hewson, *University of Wisconsin*

Conceptual Astronomy: A Research-Based Paradigm for Teaching Science Classes

Michael Zeilik, *University of New Mexico*; Walt Bisard, *Central Michigan University*

Conceptual Change within Vygotsky's Zone of Proximal-Development

Melissa Rua, Gail Jones, *University of North Carolina-Chapel Hill*; Glenda Carter, *North Carolina State University*

Integrated Science: Students' Conceptions and Conceptual Change

Susan Koba, *Omaha Public Schools & University of Nebraska at Lincoln*; Kelly Gatewood, Deirdra Rochell, Ginger Hawhee, *Omaha, NE*

Teaching for Understanding in Science: What Counts as Conceptual Change?

Michael Beeth, *Ohio State Unversity*; Sister M. Gertrude Hennessey, *St. Ann's School*

Mental and Physical Models of the Earth in Space: Achieving Conceptual Change in a College Science Course

Harry L. Shipman, Cynthia Cuddy, *University of Delaware*

The Beginning Teacher: Knowledge and Expectations **Missouri Pacific**

(C Teaching: Paper Set Grouped by Committee)

Presider: Sharon Parsons, *San Jose State University*

A Year Long Study of a Beginning Taiwanese Science Teacher's Pedagogical Content Knowledge and Its Development

Hsiao-lin Tuan, *National Changhua University of Education, Republic of China*; Rong-Cheng Kao, *Hsing-Sheng Junior High School, Republic of China*

Beginning Science Teacher Cognition and Its Origins in the Preservice Secondary Science Teacher Program

Paul E. Adams, Gerald H. Krockover, *Purdue University*

What are the Science Needs of Beginning K-12 Science Teachers in Missouri?

Lloyd H. Barrow, Donna Plummer, *University of Missouri*

Educational Reconstruction **Regency B**

(E Curriculum, Evaluation, and Assessment: Paper Set Organized by Proposer)

Presider: Larry Yore, *University of Victoria*

Discussant: Richard Duschl, *Vanderbilt University*

A Model of Educational Reconstruction-Theoretical Foundations

Ulrich Kattmann, *University of Oldenburg, Germany*; Reinders Duit, *University of Kiel, Germany*

Educational Reconstruction of Visual Perception

Harald Gropengiefler, *University of Oldenburg, Germany*

Educational Reconstruction of Key Issues of Theories of Deterministic Chaos

Reinders Duit, Michael Komorek, *University of Kiel, Germany*

Textbook without Paper – Teaching in Cyberspace **Regency C**

(B Learning: Classroom Contexts and Learner Characteristics: Invited Address)
Presider: Thomas R. Koballa, Jr., *University of Georgia*
Presenter:
George Johnson, *Washington University of St. Louis*

Collaborative Partnerships in Science Education **Wabash Cannonball**

(B Learning: Classroom Contexts and Learner Characteristics: Discussion Group)
Presider: Fred Finley, *University of Minnesota*

Perspectives on Collaboration in the Classroom: Students, Scientist, Classroom Teacher, and Researcher
Beatrice L. Taylor, *Fairfax County Public Schools*; John Kowalski, *Roanoke Valley Governor's School*; Mara Sabre, *The Crane Foundation*

Culture as Context in the Teaching of Science
Lilia Reyes-Herrera, *Florida State University*

Scientist and Elementary Teacher Partnerships: Evolution Through Evaluation
Betty A. Wier, *University of Delaware*

Collaborative Linkages to Create Culturally Relevant Curriculum
Mark D. Guy, *University of North Dakota*

2:45 PM — 3:45 PM Strand Sessions Monday, April 1, 1996

Uses of Portfolios to Assess Science Teaching and Learning **Burlington Route**

(D Teacher Education: Paper Set Grouped by Committee)
Presider: Daniel Shepardson, *Purdue University*

Portfolios Reflect Teacher Knowledge and Instruction
Ruth Caswell, Kathleen Filkins, *Texas Women's University*; Karla Nelsen, *Denton Independent School District*; Carlton Wendel, *Texas Women's University*

Portfolio Assessment in High School Physics
Dennis Nickelson, *Jefferson City High School*

Computer Assisted Concept Mapping **Frisco**

(G Educational Technology: Paper Set Grouped by Committee)
Presider: Robert Sherwood, *Vanderbilt University*

Students' Use Of Concept Maps To Guide Multimedia Science Instruction
Carl F. Berger, Tricia Jones, *University of Michigan*; Neil Skov, *Concordia College*

Computer Assisted Concept Mapping and Analysis
Barbara Fife, *Northville Public Schools*; Carl Berger, *University of Michigan*

Mirror, Mirror on the Wall, Who is the Fairest One of All? **Grand A**

(F Cultural, Social and Gender Issues: Novel Format)
Presider: Karen Meyers, *University of British Columbia*
Discussant: Sharon Parsons, *San Jose State University*
Participants:
Karen Meyers, *University of British Columbia*; Sharon Parsons, *San Jose State University*

Measures of Science-Related Motivation and Stress **Grand B**

(B Learning: Classroom Contexts and Learner Characteristics: Paper Set Grouped by Committee)
Presider: Eric Pyle, *West Virginia University*

Aspects of Science Instruction in the View of German Junior High School Students: Conception and Application of the Computer-Assisted Procedure for the Analysis of Motivational Learning Climate Issues in Biology, Chemistry and Physics Instruction
Claus Bolte, *University of Kiel, Germany*

The Validity of the Science Student Stress Inventory Using a Sample of South African High School Students
Olugbemiro Jegede, *University of Southern Queensland, Australia*; Prem Naidoo, *University of Durban Westville, South Africa*; Peter Okebukola, *Lagos State University, Nigeria*

Does School Science Make a Difference? Regency C

(E Curriculum, Evaluation, and Assessment: Invited Address)
Presider: Thomas Koballa, Jr., *University of Georgia*
Presenter:
David P. Butts, *University of Georgia*

Preservice Elementary Teachers' Representation of Science Grand C

(D Teacher Education: Paper Set Grouped by Committee)
Presider: Michael Kamen, *Auburn University*

Preservice Elementary Teachers' Representations of Science: Photography of Science in Your Neighborhood
Gilbert L. Naizer, *Ohio State University at Newark*

Elementary Student Teacher's Science Content Representations
Carla M. Zembal, *Louisiana State University*; Joseph S. Krajcik, Phyllis C. Blumenfeld, *University of Michigan*

Effects of Computer Animation on Problem Solving and Concept Attainment in Chemistry Grand D

(G Educational Technology: Paper Set Grouped by Committee)
Presider: Nancy Songer, *University of Colorado-Boulder*

The Use of Kinetic and Static Visuals in Organic Chemistry
Michael R. Abraham, *University of Oklahoma*; Abdulwali H. Aldahmash, *Sanna University, Republic of Yemen*

Computer Animation, Mental Modeling, and Algorithmic-Conceptual Equilibrium Problem Solving of College Chemistry Students
Vickie M. Williamson, *Illinois State University*; Mark S. Cracolice, *University of Montana*

Design and Use of Flexible Search Systems For Curricular Data Bases Grand E

(E Curriculum, Evaluation, and Assessment: Novel Format)
Presider: Mary Budd Rowe, *Stanford University*
Participants:
Mary Budd Rowe, *Stanford University*; Richard McLeod, *Michigan State University*; Emily Girault, *San Francisco University*; Francis Lawlor, *Independant Museum Consultant*; Sebastian Foti, *Stanford University*

Science for All Students: Challenges for the Next Quarter Century Regency A

(D Teacher Education: Invited Address)
Presider: Deborah Tippins, *University of Georgia*
Presenter:
James Gallagher, *Michigan State University*

Conceptions of Technology Held by Children and Adults Jeffersonian

(G Educational Technology: Paper Set Grouped by Committee)
Presider: Lawrence Scharmann, *Kansas State University*

A Mennonite Community: A Supplemental Definition of Technology
William R. Veal, Denise Crockett, *University of Georgia*

Testing a Model of Children's Conceptions of Technology
Tina Jarvis, *Leicester University, England*; Léonie J. Rennie, *Curtin University of Technology, Australia*

Collaborative Action Research in Science Education: Issues and Dilemma Missouri Pacific

(D Teacher Education: Paper Set Grouped by Committee)
Presider: Gail Jones, *University of North Carolina-Chapel Hill*

Coordinating and Supporting Teacher Research within a School District
Donna F. Berlin, *Ohio State University*; John J. Smith, *Goshen College*; Arthur L. White, *Ohio State University*; Gene Hungate, *Elkhart Community Schools*

Collaborative Action Research, Reform, and the Need for Triple Consciousness
Frank E. Crawley, *East Carolina University*

Views and Portrayals of the Nature of Science in High School Classrooms

New York Central

(H History, Philosophy and Epistemology: Paper Set Grouped by Committee)

Presider: Catherine Cummins, *Louisiana State University*

What Science Should We Teach? Teachers' Views on the Nature of Science and the Moral Dimensions of Science Teaching

Jenifer V. Helms, *Stanford University*

The Nature of Science as Viewed by Students and their Teacher and as Enacted in Curriculum

Keith B. Lucas, Campbell J. McRobbie, *Queensland University of Technology, Australia*

Conceptual Change and Choices in the Biological and Environmental Sciences

Regency A

(B Learning: Classroom Contexts and Learner Characteristics: Paper Set Grouped by Committee)

Presider: James Shymansky, *University of Iowa*

Structured Controversy As A Strategy For Conceptual Change In Environmental Science

Jerry P. Beilby, *Northwestern College*; Fred N. Finley, *University of Minnesota*

Daily Choices and Consequences as Seen through an Environmental Lens: Examining Individuals' Envioronmental Responsiveness

Christine Kelly, *University of Maryland, College Park*

Knowledge Restructuring in the Life Sciences: A Longitudinal Study of Conceptual Change in Biology

Joel J. Mintzes, N. Renee Pearsall, Jo El J. Skipper, *University of North Carolina at Wilmington*

The Use of Analogies in an Industrial Environment to Facilitate Status Changes for Radiation Science Concepts

Charles T. Lohrke, Robert Poel, *Western Michigan University*

Social and Cultural Factors that Affect Science Curriculum Development

Regency B

(E Curriculum, Evaluation, and Assessment: Paper Set Grouped by Committee)

Presider: Katherine Wieseman, *University of Georgia*

Power, Agency, and the Elementary School Science Curriculum

Michael T. Hayes, *University of Utah*

Cultural Synergy and the "Model For Negotiation" in the Development of a Nigerian Science Curriculum

David B. Deru, Joseph P. Riley , *University of Georgia*

Issues of Preservice Teacher Education

Wabash Cannonball

(D Teacher Education: Round Table)

Presider: Ronald Anderson, *University of Colorado*

Challenging Preservice Teachers' Beliefs About Science

Susan J. Doubler, Rebecca B. Corwin, *Technology Education Research Center*

What Does That Word Mean? The Role of Terminology in Science Classrooms

Noelle Griffiths, *Florida State University*

4:00 PM — 5:30 PM Strand Sessions Monday, April 1, 1996

NSF Programs for Science Education

Frisco

(Invited Session)

Presider: Larry Enochs, *University of Wisconsin-Milwaukee*

Participants:

James D. Ellis, Daryl E. Chubin, *National Science Foundation*

Students' Problem Solving Performance

Burlington Route

(B Learning: Classroom Contexts and Learner Characteristics: Paper Set Grouped by Committee)

Presider: Mary Nakhleh, *Purdue University*

Conflict and Consensus in Elementary Children's Small Group Problem Solving

Lori A. Kurth, Edward L. Smith, *Michigan State University*

A Physics Problem Solving Model for Developing Interpretation Skills

Nageswar Rao Chekuri, Glenn C. Markle, *University of Cincinnati*

Influence of Immediate Observations on Students' Performance on Water-Level Problems

Hsiang-Wu Huang, Yun-Ju Chiu, *National Taiwan Normal University, Republic of China*

Creating Gender Sensitive Environments in Science Education

Grand A

(F Cultural, Social and Gender Issues: Paper Set Organized by Proposer)

Presider: Gail M. Shroyer, *Kansas State University*

Discussant: Nancy Brickhouse, *University of Delaware*

Science Support Groups and Women Science Educators: Advocates for Women's and Girls' Legitimate Participation in Science

Kathleen S. Davis, *University of Colorado-Boulder*

"I'm Just Not Interested": Gender-Related Responses in a High School Chemistry Program

Jane O. Larson, *University of Colorado-Boulder*

Inside a Gender-Sensitive Environment: An All Girls Physics Class

MaryAnn Varanka-Martin, *Estes Park High School*

Implementing a Model Multicultural Science Education Program: University, Industry and District Collaboration

Grand B

(D Teacher Education: Paper Set Organized by Proposer)

Presider: Pamela Fraser-Abder, *New York University*

Discussant: James Gallagher, *Michigan State University*

Preparing Teachers to Teach in Multicultural Communities

Pamela Fraser-Abder, *New York University*

Multicultural Science and Teacher Education

Brian Murfin, *New York University*

Implementing a Multicultural Science Education Program in a School District

Annette Saturnelli, *Newburgh Enlarged City School District*

Inservice Impact on Teachers' Content Knowledge, Content Pedagogical Knowledge and Perspectives on Science Teaching: The Science Parents-Activities-Literature Project (Science PALs)

Grand C

(D Teacher Education: Symposium)

Presider: James A. Shymansky, *University of Iowa*

Discussant: Bill Dutton, *Iowa City Community Schools*

Participants:

James A. Shymansky, John Dunkhase, Eric Olsen, Laura Henriques, Becky Monhardt, Jennifer Chidsey, Leigh Monhardt, Ibrahim Al-Momani , Gary Varrella, Deborah Dunkhase, *University of Iowa*; Bill Dutton, Jeanne Jones, *Iowa City Community Schools*, Larry Yore, *University of Victoria*

Student and Teacher Understandings of Environmental Issues

Grand D

(A Learning: Students' Conceptions & Conceptual Change: Paper Set Grouped by Committee)

Presider: Helen Parke, *East Carolina University*

Determining the Teaching Concepts About "The Earth as a Complex Environmental System" in Elementary Schools in Taiwan

Jong-pyng Chyuan, *National Taipei Teachers College, Republic of China*

The Relationship of College Student Perceptions of Global Warming to Four Demographic Variables

Fred Groves, Ava Pugh, *Northeast Louisiana University*

A Study of Taiwan Elementary Students' Understanding of Ecological Stability

Chao-Ti Hsiung, Jing-Yi Chang, Tung-Hsing Hsiung, *National Taitung Teachers College, Republic of China*

Students' Perceptions of Science and Science Learning

Grand E

(B Learning: Classroom Contexts and Learner Characteristics: Paper Set Grouped by Committee)

Presider: Norman Lederman, *Oregon State University*

Changing Schools, Changing Science: A Student's Point Of View

Wendy Speering, Léonie Rennie, *Curtin University of Technology, Australia*

Student's Perception of Cooperative Learning in Earth-Science Fieldwork

Nir Orion, *Weizmann Institute of Science, Israel*; Richard Kempa, *University of Keele, England*

Perceptions about Persistence in Undergraduate Physics

Jesus Vazquez-Abad, Laura R. Winer, Jean-Robert Derome, *Université de Montréal*

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The Role of School Size and Gender in Students' Perceptions of Science During the Transition from Elementary to High School
Peter D. Ferguson, *University of Tasmania, Australia*; Barry J. Fraser, *Curtin University of Technology, Australia*

Improving Teaching and Learning in Science Education — Grand F

(A Learning: Students' Conceptions & Conceptual Change: Symposium)
Presider: David F. Treagust, *Curtin University of Technology, Australia*
Discussant: Vincent N. Lunetta, *Pennsylvania State University*
Participants:
David F. Treagust, *Curtin University of Technology, Australia*; Reinders Duit, *University of Kiel, Germany*; Hans Niedderer, *University of Bremen, Germany*; James J. Gallagher, *Michigan State University*; Vincent N. Lunetta, *Pennsylvania State University*

Assistance for Beginning Science Teachers — Jeffersonian

(C Teaching: Paper Set Grouped by Committee)
Presider: Sue Mattson, *Harvard-Smithsonian Center for Astrophysics*

The Nature of the Roles and Relationships in an Induction Mentoring Model
Priscilla S. Golley, Patricia Daniel, *Georgia State University*; John Wiggins, *Georgia Institute of Technology*

Components of a Science and Mathematics Teacher Induction Model
John R. Wiggins, *Georgia Institute of Technology*; Kim Nichols, *University of Georgia*

Inventing a Professional Practice of Teaching
Mark Volkmann, Maria Anderson, *Purdue University*

Secondary Science Teaching Analysis Matrix: A New Instrument For Studying Secondary Science Teaching
Joyce Parker, Donald Duggan-Haas, *Michigan State University*

Interpretive Autobiography as a Method to Investigate Teacher Learning — Missouri Pacific

(C Teaching: Paper Set Organized by Proposer)
Presider: Nancy T. Davis, *Florida State University*

A Mirror for Reflection: Working with Science Interns
John Schaller, *Florida State University*

Becoming Centered: An Autobiography of a High School Chemistry Teacher
Maggie Helly, *Mosley High School*

Patterns of Learning Revealed Through Autobiography
Nancy T. Davis, *Florida State University*

This is Your Life: The Autobiography as an Integral Part of Praxis with Science Education Students
Mary M. Cozean Alexander, *Florida State University-Panama City*

Values and Their Influence on the Construction of Classroom Environment — New York Central

(H History, Philosophy and Epistemology: Paper Set Organized by Proposer)
Presider: Lon Richardson, *New Mexico State University*

The Influence of Student Values on Perception of the Dissection Experience
Elizabeth C. Doster, David F. Jackson, *University of Georgia*

The Influence of Values on Technology, Education, and Culture in a U. S. Mennonite Community
Denise Crockett, *University of Georgia*

Preservice Teacher Reflections on their Personal Experience in a Democratic/Brain-Based Educational Environment
Lon Richardson, *New Mexico State University*

Generalizing Some of the Current Reform Projects in Science Education into An Action Research and Development Model For Educational Scholarship — Regency A

(E Curriculum, Evaluation, and Assessment: Symposium)
Presider: Charles McFadden, *University of New Brunswick*
Discussant: George Dawson, *Florida State University*
Participants:
Charles McFadden, *University of New Brunswick*; Cheryl Mason, *San Diego State University*; Robert Yager, *University of Iowa*

Evaluating Interdisciplinary Science Projects **Regency B**

(E Curriculum, Evaluation, and Assessment: Paper Set Grouped by Committee)

Presider: Preston Prather, *University of Virginia*

Project IMAST: Evaluating Integrated Learning

Robert L. Fisher, John A. Dossey, Vickie M. Williamson, *Illinois State University*

Barriers to Integrating Science, Mathematics, and Technology

Trudy Shea, Robert L. Fisher, *Illinois State University*

A Case Study as a Tool for Evaluating an Industry-Environment Project

Revital T. Tal, Yehudit J. Dori, Reuven Lazarowitz, *Technion-Israel Institute of Technology, Israel*

Issues of Gender Equity and Cultural Inclusion in Preservice Teacher Education **Regency C**

(D Teacher Education: Paper Set Grouped by Committee)

Presider: Lynda Flage, *University of Georgia*

Conflicts, Mistakes, and Successes in Using Case Studies of Inclusion in an Elementary Science Methods Course

Julie Gess-Newsome, Sherry S. Demastes, *University of Utah*

Institutionalizing Gender Equity in Preservice Teacher Education

Jo Sanders, *City Univerity of New York*

Student Learning in the Physical Sciences **Wabash Cannonball**

(A Learning: Students' Conceptions & Conceptual Change: Discussion Group)

Presider: Campbell McRobbie, *Queensland University of Technology*

Students' Understanding of Molecular Structure and Properties of Organic Compounds

Hans-Jürgen Schmidt, *University of Dortmund, Germany*

Teacher Goals and Student Perceptions: A Qualitative Look at a Quantitative Problem

D. Allan Brunner, *Oregon State University*

An Alternative Approach in Science Learning: Active Learning Relating to the Concept of Motion in a Non-Science College Level Class

Abdullah Abbas, *Florida State University*

TUESDAY April 2, 1996

Program Overview

Session	Room	Time
Committee Meetings		7:00 am - 8:30 am
STRAND SESSIONS	rooms as listed in schedule	8:30 am - 10:00 am
STRAND SESSIONS	rooms as listed in schedule	10:30 am - 12:00 pm
Awards Lunch		12:00 pm - 2:30 pm
STRAND & POSTER SESSIONS	rooms as listed in schedule	2:30 pm -3:30 pm
STRAND & POSTER SESSIONS	rooms as listed in schedule	4:00 pm - 5:00 pm
NARST Outstanding Paper Presentation	FRISCO	4:00 pm - 5:00 pm
NARST Business Meeting	ILLINOIS CENTRAL	5:00 pm - 6:00 pm
Next Generation of Researchers' Dinner Chat Laura Barden (Western Illinois University), Amanda McConney (Western Michigan University)	FRISCO	6:00 pm - 7:30 pm
Entertainment And Now for Something Completely Different... John Settlage (Cleveland State University) and Company	GRAND A, B, C	7:30 pm - 8:30 pm

Special Interest Round Table Discussions		8:30 pm – 9:30 pm
Strand A: Learning: Students' Conceptions and Conceptual Change Strand B: Learning: Classroom Context and Learner Characteristics Strand C: Teaching	REGENCY A	
Strand D: Teahcer Education Strand E: Curriculum, Evaluation and Assessment Strand F: Cultural, Social and Gender Issues	REGENCY B	
Strand G: Educational technology Strand H: History, Philosophy and Epistemology Strand I: Sessions in the Spanish Language Strnad J: Informal Learning	REGENCY C	

TUESDAY April 2, 1996

Strand Highlights

Sponsor	Session	Time & Room
STRAND E	*Designing Curriculum Materials to Serve Science Literacy Goals: The Role of Research* Sofia Kesidou, Peter Hewson, Alan Hofmeister, Susan Matthews, Edward Smith	4:00 pm – 5:00 pm JEFFERSONIAN
STRAND I	*Science Education Research in the Spanish Language* Beatriz Carrera, Cecilia Cuevas Arteaga, Carman Ponte De Chacin	8:30 am – 10:00 am FRISCO
STRAND J	*Developing Gender Equity at Home: The Influence of the Exploratorium "Science At Home" Project on Parental Attitudes, Perceptions, and Behaviors* Linda S. Shore	10:30 am – 12:00 pm REGENCY A

7:00 AM — 8:30 AM Committee Meetings Tuesday, April 2, 1996

Publications Advisory Committee **Colorado Eagle**
Presider: Kathleen Roth, *Michigan State University*

Ad hoc Committee on Recruiting and Retaining Members **Dixie Flyer**
Presider: Ken Tobin, *Florida State University*

Graduate Students and New Researchers Committee **Jeffersonian**
Presider: William Holliday, Christine Kelly, *University of Maryland*

Election Committee **Meteor**
Presider: Barry Fraser, *Curtin University of Technology*

Research Committee **Midnight Special**
Presider: Robert Sherwood, *Vanderbilt University*

Ad hoc Political Action Committee **Texas Special**
Presider: Michael Klapper, *Ohio State University*

International Committee **Frisco**
Presider: Peter Hewson, *University of Wisconsin*

Liaison with Scientific Societies Committee **Zephyr Rocket**
Presider: Diane Ebert-May, *Northern Arizona University*, Susan Speece, *Anderson University*

8:30 AM — 10:00 AM Strand Sessions Tuesday, April 2, 1996

Student Teachers: Outsiders in the Curriculum Reform Process **Burlington Route**
(D Teacher Education: Novel Format)
Presider: Sharon Hudson, *Morehead State University*
Presenter:
Joan M. Whitworth, *Morehead State University*

Science Education Research Reported in the Spanish Language **Frisco**
(I Sessions in the Spanish Language: Paper Set Grouped by Committee)
Presider: Monsoor Niaz, *Universidad de Oriente, Venezuela*

Envestigaciones en la Maestria en Educación Ambiental del Instituto Pedagogico de Caracas, a Traves de los Proyectos de Tesis
Beatriz Carrera, *Instituto Pedagogico De Caracas, Venezuela*

Evaluacion de Resultados de un Curso de Actualización Dirigiso a un Grupo Interdisciplinario
Cecilia Cuevas Arteaga, *Universidad Autonoma Del Estado De Morelos, Mexico*

Uso de los Mapas de Conceptos como Herramienta para Procesar Articulos de Periodicos Relacionados con la Problematica Ambiental
Carmen Ponte De Chacin, *Instituto Pedagogico De Caracas, Venezuela*

"It's Really Nice to Work with Young People": Is Science Teaching "Women's True Profession"? **Grand A**

(F Cultural, Social and Gender Issues: Symposium)
Presider: Hepsi Zsodos, *University of Delaware*
Discussant: Kathleen Davis, *University of Colorado*
Participants:
Kathryn Scantlebury, William J. Letts, IV, Bambi L. Bailey, *University of Delaware*

Studies on Learning Processes **Grand B**

(A Learning: Students' Conceptions & Conceptual Change: Paper Set Organized by Proposer)
Presider: Reinders Duit, *University of Kiel, Germany*
Discussant: Dewey Dykstra, *Boise State University*

Learning Processes in Electric Circuits
Hans Niedderer, *University of Bremen, Germany*; Fred Goldberg, *San Diego State University*

Thinking with Hands, Eyes, and Signs: The Development of Multimedia Science
Wolff-Michael Roth, *Simon Fraser University*

Conceptual Change on Conceptual Growth: Students' Pathways Towards Understanding Limited Predictability of Chaotic Systems
Michael Komorek, *University of Kiel, Germany*

Reforming Instructional Practice: Change Agent in Preservice and Inservice Contexts **Grand C**

(D Teacher Education: Paper Set Organized by Proposer)
Presider: Glenda Carter, *North Carolina State University*
Discussant: Susan L. Westbrook , *North Carolina State University*

Negotiating Reform-Directed Change Among Preservice Students, Cooperating, Teachers and University Science Educators
Laurn N. Rogers, *University of North Carolina-Wilmington*

Alternative Assessment as a Change Agent for Instructional Practice
Glenda Carter, Sarah B. Berenson, Draga Vidakovic, *North Carolina State University*

The Impact of Peer Conflict on Implementing Instructional Change
Mary Alice Leonard, Susan L. Westbrook, *North Carolina State University*

NSF Collaboratives for Excellence in Teachers' Preparation: Three Case Studies Of Collaboration Used To Reform Teacher Preparation In Science And Mathematics **Illinois Central**

(D Teacher Education: Symposium)
Presider: J. Randy McGinnis, *University of Maryland*
Participants:
J. Randy McGinnis, *University of Maryland*; Fletcher Brown, *University of Montana*; Glen Bruckhart, *Colorado State University*; Elisabeth Charron, *Montana State University*; Kathryn Cochran, Rose Shaw, *University of Northern Colorado*; Barbara Nelson, *Colorado State University*; John Graves, *Montforton School and Montana State University*; Tad Watanabe, *University of Maryland*

The Nature of Science: Issues Related to Science Teaching and Learning **Jeffersonian**

(H History, Philosophy and Epistemology: Paper Set Grouped by Committee)
Presider: Mary Atwater, *University of Georgia*

Mea Culpa: Formal Education and the DIS-Integrated World
Brian P. Coppola, *University of Michigan*; Douglas S. Daniels, *Scripps Research Institute*

Teaching About the Nature of Science through Science Fairs: Judges' Perspectives on Student Learning
Catherine L. Cummins, *Louisiana State University*

Sociology and Epistemology of Science According to Lebanese Educators, University Students, and High School Students
Saouma BouJaoude, *American University of Beirut*

Observation in Science Classes: Students' Beliefs About Its Nature and Purpose
Richard Gunstone, Filocha Haslam, *Monash University, Australia*

Biology Teaching and Learning — Missouri Pacific

(D Teacher Education: Paper Set Grouped by Committee)
Presider: Melissa Warden, *Ball State University*

Assessing the Long-Term Impact of an Enhancement Program for Life Science Teachers
Roy W. Hurst, *University of Texas-Permian Basin*

Exploring Essential Topics to Teach High School Biology Students
Eugene L. Chiappetta, *University of Houston*; David A. Fillman, *Galena Park Schools*

Students' Patterns of Biological Explanations: Trends in Knowledge Frameworks and Spontaneous Explanations
Sherry S. Demastes, *University of Utah*; Eleanor Abrams, *Universtiy of New Hampshire*; Catherine Cummins, *Louisiana State University*

Biology 101: A Constructivist Perspective on Teaching Undergraduate Non-Major College Biology
Hedy Moscovici, *Western Washington University*

Sociology of Science: Theoretical Constructs, Applications, and Implications For Science Education — New York Central

(H History, Philosophy and Epistemology: Symposium)
Presider: Nancy Brickhouse, *University of Delaware*
Discussant: Richard Duschl, *Vanderbilt University*
Participants:
Christine M. Cunningham, *Cornell University*; Jenifer Helms, *Stanford University*; Gregory J. Kelly, *University of California-Santa Barbara*; Wolff-Michael Roth, *Simon Fraser University*; William S. Carlsen, *Cornell University*

The Iowa SS&C Project: Progress and Promises of A National Science Education Reform Initiative — Regency A

(E Curriculum, Evaluation, and Assessment: Symposium)
Presider: Susan Blunck, *University of Maryland*
Discussant: John Penick, *University of Iowa*
Participants:
Chin-Tang Liu, Robert E. Yager, *University of Iowa*; Judith Burry-Stock, *University of Alabama*; Gary Varrella, Chin-Tang Liu, Mark Trax, Robyn Freeman, Sandy Enger, JoAnn Lewis, *University of Iowa*

Science Education Reform: Issues and Outcomes — Regency B

(E Curriculum, Evaluation, and Assessment: Paper Set Grouped by Committee)
Presider: Larry Enochs, *University of Wisconsin-Milwaukee*

The Use of Integrative Units as the Basis for Middle School Curriculum: Meeting National Science Content Standards
Bruno G. Hicks, *University of Maine*

Entering the National Reform Fray: An OECD Case Study of Project 2061
Julie A. Bianchini, *California State University-Long Beach*; Nicole I. Holthuis, *Stanford University*

Understanding the Elementary Teacher: A Vital First Step in Science Education Reform
Maria A. Anderson, *Purdue University*

Defining Public Issues and Concerns Regarding Science Education Reform in Iowa: An Internet Research Project
John Craven, III, Chris Lawrence, *University of Iowa*

Science Education Reform: Outcomes and Insights — Wabash Cannonball

(C Teaching: Paper Set Grouped by Committee)
Presider: René Stofflet, *University of Illinois*

The Road To Scientific Literacy Can Be Lost at Critical Junctures
John E. Trowbridge, *Southeastern Louisiana University*; James H. Wandersee, *Louisiana State University*

Relationship Between Teacher Beliefs and Science Education Reform: What Are Teachers' Beliefs About Thematic Units?
Charlene M. Czerniak, Andrew T. Lumpe, Trudy Grafton, *University of Toledo*

Towards an Outcome Based Science Education System: A Description of the Western Australian Process
Fred Deshon, *Education Department of Western Australia*; Tony Fetherston, *Edith Cowan University, Australia*

Intended and Unintended Changes in Postsecondary Students' Decision-Making Orientation and Higher-Order Cognitive Skill Profiles

Amanda Woods McConney, *Western Michigan University*; Uri Zoller, *Haifa University-Oranim, Israel*; Andrew McConney, *Western Michigan University*

10:30 AM — 12:00 PM Strand Sessions Tuesday, April 2, 1996

Developing Electronic Communities of Teachers and Leaders · Frisco

(D Teacher Education: Paper Set Grouped by Committee)

Presider: Carol Stuessy, *Texas A& M University*

Developing An Electronic Community to Foster Collaboration: Defining the Needs, Concerns and Issues of Prospective Participants

Joni Falk, Jack Lochhead, Billy Spitzer, *Technology Education Research Center*

Science Teacher Socialization through Telecommunication

Mary E. Caggiano, Richard Audet, Gerald Abegg, *Boston University*

Internet Resources for Middle School Science: Golden Opportunity or Silicon Snake Oil?

David F. Jackson, *University of Georgia*; Gretchen Bourdeau, *Oglethorpe County Middle School*; Thomas J. Hagen, *University of Georgia*

Chemistry Learning at the College Level Grand A

(E Curriculum, Evaluation, and Assessment: Paper Set Grouped by Committee)

Presider: Claus Bolte, *University of Kiel, Germany*

Life After ChemCom: Do They Succeed in University-Level Chemistry Courses?

Diana Mason, *University of Texas at Austin*

Assessing Student Learning in Chemistry: A Demonstration of Task Format Affecting Student Thinking

Craig W. Bowen, *University of Southern Mississippi*; Jennifer Prinkey, *Edinboro University of Pennsylvania*; Gayle Mize, *Biloxi, MS*

Integrating Computational Chemistry into a Structured Study Group Program for First-Year University Honors Students

Brian P. Coppola, *University of Michigan*; Douglas S. Daniels, *Scripps Research Institute*; Scott T. Lefurgy, *University of Michigan*

Assessing the Critical Thinking Strategies Utilized by Community College Chemistry Students

Wayne R. Morgan, *Hutchinson Community College*; Emmett L. Wright, *Kansas State University*

Preservice Elementary Teacher Preparation in Science Grand B

(D Teacher Education: Paper Set Grouped by Committee)

Presider: David Butts, *University of Georgia*

Factors Influencing the Self Efficacy of Elementary Preservice Teachers as Science Educators: Science Education Methods Courses, Current Knowledge of Science, and Subjective Explanations of Past Science Performance

Ranald Jarrell, Peter Rillero, William Cobern, *Arizona State University West*

Pre-Service Elementary Teachers' Professional Development: Negotiating Power, Pedagogy, and Praxis

M. Jenice French, Margaret Bolick, Carol Borchers, *Kansas State University*

What Works and What Doesn't: An Examination of Earth Science Content Courses for Pre-Service Elementary Teachers

Kathie M. Black, *University of Victoria*

Making a Difference in Science Learning: How the New Constructivist Curriculum Can Build a Brighter Future for Tomorrow's Students

Ling L. Liang, *Indiana University*

Changing the Beliefs and Understandings of Preservice and Novice Teachers Grand C

(D Teacher Education: Paper Set Grouped by Committee)

Presider: Thomas Dana, *Pennsylvania State University*

Factors in Preservice Teachers' Acceptance of Science Education as a Valid Source of Knowledge for Teaching

Annette LaRussa, *University of Georgia*

Conceptual Changes in a Preservice Teacher's Beliefs in Constructing a Model for Science Teaching

Bharati S. K. Devi, Mary M. Atwater, *University of Georgia*

Science Teaching Self-Efficacy of Novice Elementary School Teachers
Ian Ginns, James Watters, *Queensland University of Technology, Australia*

Facilitating Elementary Teacher Candidates' Understanding of Conceptual Change Theory
René T. Stofflett, *University of Illinois at Urbana-Champaign*

A State Model of Collaboration — Illinois Central

(D Teacher Education: Paper Set Organized by Proposer)
Presider: James P. Barufaldi, *University of Texas at Austin*

Exploring Issues in Collaborative Professional Development for Science Teachers
Kamil A. Jbeily, *Texas Education Agency*

Case Study: The Lower Rio Grande Valley Regional Collaborative for Excellence in Science Teaching
Kathy I. Norman, *University of Texas at Brownsville*

Scaling Up Regional Collaborative Activities: Assessment and Dissemination Strategies
James P. Barufaldi, *University of Texas at Austin*

Physics Teaching and Learning — Jeffersonian

(E Curriculum, Evaluation, and Assessment: Paper Set Grouped by Committee)
Presider: Wolff-Michael Roth, *Simon Fraser University*
Discussant: Miriam Reiner, *Technion-Israel Institute of Technology*

Status of Physics in Small Missouri High Schools and the Potential Applicability for Virtual Laboratory Utilization
Ronald C. Frederick, *Columbia Public Schools*; Lloyd H. Barrow, *University of Missouri-Columbia*

The Cultural Contexts of Physics Students' Use of Proportional Reasoning in a Nonwestern Country
Ayo Harriet Akatugba, John Wallace, *Curtin University of Technology, Australia*

Does a Science Curriculum Discipline Focused on Lab Activities Promote Creativity and Critical Thinking?
Mauricia Oliveira, Margarida S. Neves, *University of Lisbon, Portugal*

The Atomic Model in Science Teaching: Learning Difficulties or Teachers' Problems?
Helmut Fischler, *Free University, Germany*

Examining Preservice and Inservice Elementary Teachers in the QUEST Project — Missouri Pacific

(C Teaching: Paper Set Organized by Proposer)
Presider: Carrie J. Gee, *Indiana University*
Discussant: Dorothy L. Gabel, *Indiana University*

Preservice Elementary Teachers: Their Science Content Knowledge, Pedagogical Knowledge, and Pedagogical Content Knowledge
Wesley S. Boberg, Carrie J. Gee, *Indiana University*

The First Year of Teaching: Science in the Elementary School
Carrie J. Gee, Dorothy L. Gabel, *Indiana University*

The Beliefs and Science Teaching Practices of Four QUEST Teachers
Amy B. Palmeri, *Vanderbilt University*

The Effectiveness of Management Demands of Science Instructional Approaches — New York Central

(B Learning: Classroom Contexts and Learner Characteristics: Paper Set Grouped by Committee)
Presider: Meta van Sickle, *University of Charleston*

Learning through Different Instructional Styles
Susan M. Stocklmayer, *Curtin University of Technology, Australia*; Richard Lockwood, Roger Dickinson, *University of West Australia*

Managing Subject Matter: Does it Really Matter?
Mark S. Latz, Norman G. Lederman, *Oregon State University*

An Interdisciplinary Research Base for Investigating the Effectiveness of Demonstrations in Concept Teaching
Kenneth W. Gattis, *North Carolina State University*

The Effect of Grouping and Two Instructional Strategies on Conceptual Understanding and on Critical Thinking Skills in Science
Maryellen Duffy, Dana L. Zeidler, *University of Massachusetts, Lowell*

Designing Curriculum Materials to Serve Science Literacy Goals: The Role of Research Regency A

(E Curriculum, Evaluation, and Assessment: Symposium)
Presider: Jo Ellen Roseman, *American Association for the Advancement of Science*
Discussant: Jo Ellen Roseman, *American Association for the Advancement of Science*
Participants:
Sofia Kesidou, *American Association for the Advancement of Science*; Peter Hewson, *University of Wisconsin*; Alan Hofmeister, *Utah State University*; Susan Matthews, *Elbert County Middle School*; Edward Smith, *Michigan State University*

The Functioning of Collaborative Learning Communities Regency B

(B Learning: Classroom Contexts and Learner Characteristics: Paper Set Grouped by Committee)
Presider: Nancy Davis, *Florida State University*

Creating a Collaborative Environment in a Middle Grade Science Classroom: Design and Enactment of an Authentic Project
Barbara A. Crawford, *Oregon State University*

PING – A Collaborative Study in Integrated Science Education
Manfred Lang, *University of Kiel, Germany*

Establishing a Science Education Learning Community: Preservice/Inservice Teachers and Teacher Educators as Co-Learners
Sharon Parsons, *San Jose State University*

Teachers' Content Knowledge and Pedagogical Content Knowledge Wabash Cannonball

(C Teaching: Paper Set Grouped by Committee)
Presider: William Veal, *University of Georgia*

Knowledge About Key Ideas: A Case Study of 'Two Middle School Science Teachers
Zongyi Deng, *Michigan State University*

The Expert-Novice Paradigm: An Epistemological Evaluation
Fernando Cajas, *Michigan State University/Universidad de San Carlos de Guatemala*

Prospective Elementary School Teachers' Conceptions of the Changes Relating to Distillation
Valanides Nicolaos, *University of Cyprus*

12:00 PM — 2:30 PM Awards Luncheon Tuesday, April 2, 1996

Grand D,E,F

2:30 PM — 3:30 PM Poster Session Tuesday, April 2, 1996

Regency C

(B Learning: Classroom Contexts and Learner Characteristics)

Parallel Courses: Comparison and Convergence of Adolescent Motivational Processes in Informal and Formal Science Education Settings
Eric J. Pyle, *West Virginia University*

Using Children's Trade Books to Teach Science: Boon or Boondoggle?
Diana C. Rice, Ann D. Rainsford, *University of South Carolina-Aiken*

Mole Problems in Chemistry: Effects of Cooperative Learning and Visual Organizers
Kathy Foley, *Northern Valley Regional High School*; Angela O'Donnell, *Rutgers University*

Question Posing Capability Using an Environmental Case Study Before and After Studying "The Quality of Air Around Us" Module
Yehudit J. Dori, Orit Hershkowitz, *Technion Israel Institute of Technology, Israel*

Do Peer Tutors Achieve Higher Academic Achievement than Their Tutees While Learning Evolution in a Cooperative Mode?
Salit Ron, Reuven Lazarowitz, *Technion Institute of Technology, Israel*

(C Teaching)

Student, Graduate, and Faculty Perspectives on Fledgling Content-Based Doctoral Programs in Science and Mathematics Education

Patrick Alan Lennon, *Southeastern Oklahoma State University*; Sharyn Rusk, *Casper College*; Jim Holden, Steven Pulos, *University of Northern Colorado*

Interactions Between Hemisphericity, Learning Type, and Concept Mapping Attributes of Preservice and Inservice Teachers

Betty L. Bitner, Farella L. Shaka, *Southwest Missouri State University*

(D Teacher Education)

Analysis of the Effectiveness of Inservice Education in Promoting Teacher Change and Educational Reform

Linda Schnipper, *Miami University of Ohio*; Joanne Tims, *Curtin University of Technology, Australia*

(F Cultural, Social and Gender Issues)

Stories Of A Female Learner in a High School Physics Classroom: Caring, Connectedness, and Voice

Scott Robinson, *SUNY College at Brockport*

(H History, Philosophy and Epistemology)

Preservice Science Teacher Perceptions of the Nature of Science and the Possible Sources

Kathyrn Powell, Diane Adoue, *Texas A&M University*

Biology Workshop '95: Exploring the Nature of Science

Melissa A. Warden, Juli K. Eflin, *Ball State University*

2:30 PM — 3:30 PM Strand Sessions Tuesday, April 2, 1996

Implications of Vygotskian Thought for Science Educators: A "Novel" Approach — Burlington Route

(B Learning: Classroom Contexts and Learner Characteristics: Novel Format)

Presider: Cathleen C. Loving, *Texas A&M University*

Participants:

Amanda Woods McConney, *Western Michigan University*; Laura Barden, *Western Illinois University*

Gender and Assessment of Physics in Context: Getting it Right! — Grand A

(F Cultural, Social and Gender Issues: Symposium)

Presider: Anita Roychoudhury, *Miami University of Ohio*

Participants:

Lesley H. Parker, Léonie J. Rennie, *Curtin University of Technology, Australia*; Gaell M. Hildebrand, *University of Melbourne, Australia*; Elizabeth Hazel, *University of Technology, Sydney, Australia*

Children's Science Learning — Grand B

(A Learning: Students' Conceptions & Conceptual Change: Paper Set Grouped by Committee)

Presider: James P. Barufaldi, *University of Texas at Austin*

Changes in Children's Questioning During Guided Co-Inquiry with Mentors

Marian L. Martinello, Linda M. Boothby, *University of Texas at San Antonio*; Elsa Duarte-Noboa, *Brauchle Elementary School*; Diane Moses, *Travis Elementary School*

Students' Responses During Discrepant Event Science Lessons

Ken Appleton, *Central Queensland University, Australia*

Science Inquiry: Student and Teacher Perceptions — Grand C

(D Teacher Education: Paper Set Grouped by Committee)

Presider: Peter Taylor, *Curtin University of Technology, Australia*

Preservice Teachers' Perceptions of Inquiry: Current Views and Future Uses

Arta Damnjanovic, Jane Butler Kahle, Jim Poth, *Miami University of Ohio*

Relationship Between Student Perspectives on Inquiry-Oriented Teaching Practice and the Nature of Science

Lawrence B. Flick, Norman G. Lederman, *Oregon State University*; Larry G. Enochs, *University of Wisconsin-Milwaukee*

Science Teaching Self-Efficacy Beliefs: A Discussion of Preservice, Inservice, and Measurement Issues

Illinois Central

(D Teacher Education: Symposium)
Presider: Larry Enochs, *University of Wisconsin-Milwaukee*
Discussant: Andrew Lumpe, *University of Toledo*
Participants:

Larry Enochs, *University of Wisconsin-Milwaukee*; Iris Riggs, *California State University-Santa Barbara*; Charlene Czerniak, *University of Toledo*; James Watters, *Queensland University of Technology, Australia*; Gail Shroyer, *Kansas State University*

Parental Involvement in Their Children's Science Education

Jeffersonian

(E Curriculum, Evaluation, and Assessment: Paper Set Grouped by Committee)
Presider: Donna Berlin, *Ohio State University*

Using Participation in Public School "Family Science Night" as a Component in the Preparation of Pre-Service Elementary Teachers
Robert B. McDonald, *Southwest Texas State University*

Can Parents Effectively Assess Their Children's Misconceptions?
Laura Henriques, Jennifer L. Chidsey, *University of Iowa*

Myths & Metaphors Related to the Practice of Science in the Classroom

Missouri Pacific

(C Teaching: Paper Set Grouped by Committee)
Presider: Sue Stocklmayer, *Curtin University of Technology, Australia*

School Science: A Fertile Culture for the Evolution of Myths
Peter Taylor, Catherine Milne, *Curtin University of Technology, Australia*

Case Studies That Document Science and School Reform

New York Central

(C Teaching: Paper Set Grouped by Committee)
Presider: Denise Crockett, *University of Georgia*

The Transformation of a Graduate Teaching Assistant: A Case Study in Undergraduate Science Reform
Woodrow L. McKenzie, George E. Glasson, *Virginia Institute of Technology*

Situated Science: Defining Science in the Context of School Reform
Gail Jones, Elizabeth M. Vesilind, *University of North Carolina at Chapel Hill*

Science Tests: Student Performance, Confidence, and Preferences

Regency A

(B Learning: Classroom Contexts and Learner Characteristics: Paper Set Grouped by Committee)
Presider: Ann Haley-Opiphant, *Miami University of Ohio*

Performance and Confidence on Science Tests: Quantitative and Qualitative Relationships
G. Michael Bowen, Michelle McGinn, *Simon Fraser University*

Examination-Type Preferences Of Secondary School Students and Their Teachers in the Science Disciplines
Uri Zoller, David Ben-Chaim, *Hifa University-Oranim, Israel*

Student Performance on an Assessment of Science Processes: Recording Data, Analyzing Data, Drawing Conclusions, and Providing Evidence
Paul J. Germann, *University of Missouri*; Roberta J. Aram, *Evangel College*

Changes in Assessment Practices of Teachers Participating In the Iowa SS&C Reform Project

Regency B

(E Curriculum, Evaluation, and Assessment: Symposium)
Presider: Gary Varrella, *University of Iowa*
Discussant: Mark F. Trax, *University of Iowa*
Presenter:

Robin Lee Harris Freedman, *University of Iowa*

Influences of Teacher Education and Professional Development **Wabash Cannonball**
(B Learning: Classroom Contexts and Learner Characteristics: Discussion Group)
Presider: Robert Yager, *University of Iowa*

Focus on Theory-Data Dialectic: Teachers' and Students' Constructions
Maria Varelas, *University of Illinois at Chicago*; Joe Becker, *University of Illinois*

The Effect of an Inquiry-Oriented Environmental Science Course on Preservice Elementary Teachers' Attitudes About Science
Fletcher S. Brown, *University of Montana*

Broad Field Science Endorsements in the United States
Sharon P. Hudson, *Morehead State University*

7th and 8th Grade Science Teachers: A Profile
Ivo Lindauer, *University of Northern Colorado*; Mary Queitzsch, *National Science Foundation*

Area Under Constructivism: A Pilot Study Using a World Wide Web Home Page to Assess Professional Development
Scott Slough, Robin McGrew-Zoubi, *Sam Houston State University*

4:00 PM — 5:00 PM NARST Oustanding Paper Tuesday, April 2, 1996

1995 NARST Outstanding Paper Presentation **Jeffersonian**
Presider: Joseph S. Krajcik, *University of Michigan*

4:00 PM — 5:00 PM Poster Session Tuesday, April 2, 1996

Regency C

(A Learning: Students' Conceptions & Conceptual Change)

Chemistry Students' Perceptual Understanding of Chemical Species in Chemical Equation Balancing
Jophus Anamuah-Mensah, *University of Cape Coast, Ghana*

Examining the Potential of Concept Mapping in Lowering the Perceived Difficulty Level of Biological Concepts
Peter Okebukola, *Lagos State University, Nigeria*; Olugbemiro J. Jegede, *University of Southern Queensland, Australia*

The Scientist in the Eyes of 13-Year-Olds in Nigeria
Rose N. Agholor, *Federal Ministry of Education , Nigeria*; Peter A. O. Okebukola, *Lagos State University, Nigeria*

(D Teacher Education)

A Study of Science Teacher Leaders' Changing Concerns Regarding the Use of Portfolio Assessment
Kimberly S. Roempler, *Ohio State University*

The Development of Preservice Teachers through Media-Based Task: A Case Study of Teacher Training Program in Taiwan
Shu Hua Lin, *National Chang-hua University of Education, Republic of China*

Practicing Teachers' Perceptions of Undergraduate Preparation For Teaching Science: A Survey of 203 Maine Teachers
Elizabeth M. Postlewaite, *SeDoMoCha Middle School*; Herman G. Weller, *University of Maine*

Attitudinal Factors That Influence Preservice Elementary Teachers' Concentration Selection
Norma E. Bermier, *University of Puerto Rico*

The Evaluation of an Innovative Science Content Course for Prospective Elementary Teachers
Andrea McLoughlin, Thomas Dana, *Pennsylvania State University*

(J Informal Learning)

How is Science Presented and Interpreted at a Natural History Museum?
Dana Riley, *Miami University of Ohio*

Novice and Veteran Informal Science Teachers: Two Preliminary Case Studies of Participating Mothers
Phyllis Katz, *University of Maryland*

4:00 PM — 5:00 PM Strand Sessions Tuesday, April 2, 1996

Factors that Affect Chemistry Learning in the High School **Burlington Route**

(A Learning: Students' Conceptions & Conceptual Change: Paper Set Grouped by Committee)
Presider: William Veal, *University of Georgia*

The Use of Mnemonics in Constructivist Teaching of Chemistry
Jacqueline K. Bowman, *Eastern Connecticut State University*

The Effectiveness of Self-Explanations in Learning High School Chemistry
Mei-Hung Chiu, *National Taiwan Normal University, Republic of China*

Uses of Computer-Based Technologies in Secondary Science Classes **Frisco**

(D Teacher Education: Paper Set Grouped by Committee)
Presider: Gerald Abegg, *Boston University*

Fostering the Use of Microcomputer Based Laboratories in Secondary Science in Quebec
Jesus Vazques-Abad, Laura Winer, Jonathan Toker, *Universite de Montreal*

EnergyNet: Learning from Year One
Robert Coulter, Alan Feldman, *Technical Education Research Center*

Effects of Gender on Biology Learning **Grand A**

(F Cultural, Social and Gender Issues: Discussion Group)
Presider: Patricia Simmons, *University of Georgia*

Gender-Related Classroom Interactions and Teachers' Beliefs in Middle School Biology Classes
Hsiao-Ching She, *National Taiwan Normal University, Republic of China*

A College Biology Unit on the Genetic Basis of Evolution, Incorportating a Historical Female Scientist and Current Social Applications
Anne-Marie Scholer, *Endicott College*

Gender-Related Differences in Error Analysis of Some Nigerian High School Students in Practical Biology
Mercy F. Ogunsola-Bandele, Faulatu K. Lawan, *Ahmadu Bello University, Nigeria*

Science Problem Solving Skill Attainment of Preservice and Inservice Teachers **Grand B**

(D Teacher Education: Paper Set Grouped by Committee)
Presider: Diana Mason, *University of Texas at Austin*

The Effect of Intensive Instruction on the Problem Solving Skills of Pre-Service Teachers in Both Clinical and Classroom Settings
Emmett L. Wright, *Kansas State University*

Implementation of Problem Solving Among Teachers Involved in a Problem Solving Demonstration Classroom Inservice
Julie L. Wilson, *University of Arizona*

Exploring Elementary Teachers' Conceptions of Science Knowledge in a Problem Solving Context
Obed Norman, *Washington State University*

Preservice Teachers' Science-Related Attitudes **Grand C**

(D Teacher Education: Paper Set Grouped by Committee)
Presider: Charlene Czerniak, *University of Toledo*

Examining the Usefulness of Field Trip Attitude Assessment Procedures in Affecting Preservice Teacher Change
Susan J. Nodurft, Joyce M. Roberts, Craig W. Bowen, *University of Southern Mississippi*

Attitudes and Experiences of Preservice Elementary/Middle Level Teachers as They Engage in Alternative Content Science Courses
David T. Crowther, Ron J. Bonnstetter, *University of Nebraska*

Science Autobiographies: What Do They Tell Us About Preservice Elementary Teachers' Attitudes Towards Science and Science Teaching?
Valerie L. Talsma, *University of Michigan*

Attitudes and Alternative Conceptions of Science Held by Preservice Elementary Teachers
Kenneth J. Schoon, *Indiana University Northwest*; William J. Boone, *Indiana University*

Students' Visual-Spatial Perceptions **Illinois Central**

(B Learning: Classroom Contexts and Learner Characteristics: Paper Set Grouped by Committee)

Presider: Ronald Good, *Louisiana State University*

VISTA: Infusing Visual/Spatial Thinking into K-8 Science Programs

Alan J. McCormack, Cheryl L. Mason, *San Diego State University*

A Look at Visual-Spatial Perception in Preservice Secondary Education Majors

Thomas R. Lord, *Indiana University of Pennsylvania*

Children's Art about Science Offers Glimpses of Visual-Spatial Competence and Development

Rita W. Peterson, *University of California, Irvine*

Developing Gender Equity at Home: The Influence of the Exploratorium "Science At Home" Project on Parental Attitudes, Perceptions and Behaviors **Jeffersonian**

(J Informal Learning: Novel Format)

Presider: Kathryn Scantlebury, *University of Delaware*

Presenter:

Linda S. Shore, *Exploratorium Teacher Institute*

Participation of Underrepresented Peoples in Science and Science Education **Missouri Pacific**

(F Cultural, Social and Gender Issues: Paper Set Grouped by Committee)

Presider: Mary Atwater, *University of Georgia*

College Freshwomen's Experiences of a Research Internship: An Analysis of Reflective Journals from Participants of the Women in Science Project (WISP)

Christine M. Cunningham, Valery S. Hussain, *Cornell University*; Mary L. Pavone, Carol Muller, *Dartmouth College*

Promoting Inclusiveness and Counteracting the Underrepresentation of People of Color in Science Education

Leslie S. Jones, *Ohio State University*

The Nature of Philosophy of Science **New York Central**

(H History, Philosophy and Epistemology: Paper Set Grouped by Committee)

Presider: Richard Duschl, *Vanderbilt University*

Whose Nature of Science?

Brian J. Alters, *University of Southern California*

Lessons from the Past: Philosophy of Science and US Science Teaching in the 1960's – The Work of James T. Robinson

Michael R. Matthews, *University of New South Wales, Australia*

View on Science Assessment Practices and Opportunities **Regency A**

(C Teaching: Paper Set Grouped by Committee)

Presider: Angelo Collins, *Vanderbilt University*

Perspectives on Assessment in Science: Voices from the Field

Daniel P. Shepardson, Paul Adams, *Purdue University*

Alternative Assessment in Secondary Science Classrooms: A Content Validity Study of Student-Constructed Artifacts

Timothy J. Breen, Joseph S. Krajcik, *University of Michigan*

Searching for Assessment Opportunities in Different Styles of Classrooms

Christine Harrison, *King's College, London, England*

The Development of a Multi-Media Portfolio for the Authentic Assessment of an In-Service/Pre-Service Science Teacher Project **Regency B**

(G Educational Technology: Novel Format)

Presider: Carl Berger, *University of Michigan*

Participants:

George E. Glasson, Woodrow L. McKenzie, *Virginia Institute of Technology*

Innovative Models of Teacher Development **Wabash Cannonball**

(C Teaching: Paper Set Grouped by Committee)

Presider: James Wandersee, *Louisiana State University*

Teacher Change in a Mandatory District-Wide Professional Development Course

Joanne Tims, *Curtin University of Technology, Australia*; Mark H. Brooks Hedstrom, *Miami University of Ohio*

"Give Value to Our Values": A Critical Theory Analysis of Community-Based Education for Native Americans

Nancy Jane Allen, *University of Texas at Austin*; Frank E. Crawley, *East Carolina University*

4:00 PM — 5:00 PM NARST Business Meeting Tuesday, April 2, 1996

Regency A

6:00 PM — 7:30 PM Dinner Tuesday, April 2, 1996

Next Generation of Researchers' Dinner Chat **Frisco**

Presiders: Laura Barden, *Western Illinois University*; Amanda McConney, *Western Michigan University*

7:30 PM — 8:30 PM Entertainment Tuesday, April 2, 1996

"And Now, For Something Completely Different. . ." **Grand D,E,F**

Participants:

John Settlage, Jr., *Academic Satirist and Adjunct Constructivist, University of Cleveland, OH*; Sherry Demastes, *Marksman and Mixologist, Amerika Forever Foundation, ID*; Julie Gess-Newsome, *Associate Dean, Brigham-Young College of Remedial Cosmetology, UT*; Catherine Cummins, *NARST Calendar Model, June 1995, February-November 1996, LA*; John Staver, *Fried Foods Columnist, Highway Eating Magazine, KS*; Ron Good, Larry Shore, and Jim Shymansky, *Residents, NARST manor, Phoenix, AZ*

8:30 PM — 9:30 PM Special Interest Groups Tuesday, April 2, 1996

A. Learning: Students' Conceptions and Conceptual Change **Regency A**

Presider: Pat Keig, *California State University-Fullerton*

B. Learning: Classroom Contexts and Learner Characteristics **Regency A**

Presider: Laura Barden, *Western IllinoisUniversity*

C. Teaching **Regency A**

Presiders: Randy Yerrick, *East Carolina University*; Gail Jones, *University of North Carolina*

D. Teacher Education **Regency B**

Presider: John Settlage, Jr., *Cleveland State University*

E. Curriculum, Evaluation, and Assessment **Regency B**

Presiders: Rodney Doran, *University of Buffalo*; Chin-Tung Liu, *University of Iowa*

F. Cultural, Social, and Gender Issues **Regency B**

Presider: Kathryn Scantlebury, *University of Delaware*

G. Educational Technology **Regency C**

Presider: Gerald Abegg, *Boston University*

H. History, Philosophy, and Epistemology **Regency C**

Presider: Cathleen Loving, *Texas A & M University*

I. Sessions in the Spanish Language **Regency C**
Presiders: Alejandro Gallard, *Florida State University*; Ramon A. Meta-Toledo, *James Madison University*

J. Informal Learning **Regency C**
Presider: Bernadette Peiffer, *SciTrek*

WEDNESDAY April 3, 1996

Program Overview

Session	Room	Time
Committee Meetings		7:00 am – 8:30 am
General Session *Discovering Discovery* William Bechtel (Washington University, St. Louis)	GRAND D, E, F	8:30 am – 10:00 am
STRAND SESSIONS	rooms as listed in schedule	10:30 am – 12:00 pm
Close of Meeting		12:00 pm
Executive Board Meeting	WABASH CANNONBALL	12:30 pm – 4:00 pm

WEDNESDAY April 3, 1996

Strand Highlights

Sponsor	Session	Time & Room
STRAND E	*Putting the New Standards into Practice: Needed Research* Ronald D. Anderson, Ronald Good, Arthur L. White	10:30 am – 12:00 pm REGENCY A
STRAND G	*Authentic Problems, Projects and SMART Challenges: Support Structures that Increase Student Achievement* John Bransford	10:30 Am – 12:00 pm FRISCO

7:00 AM — 8:30 AM Committee Meetings Wednesday, April 3, 1996

Equity Committee

Colorado Eagle

Presider: Sandra Abell, *Purdue University*

NARST-Net Ad Hoc Committee

Frisco

Presider: Derrick Lavoie, *University of Northern Iowa*

Program Committee

Jeffersonian

Presider: Tom Koballa, *University of Georgia*; Kathleen Fisher, *San Diego State University*

Financial Advisory Committee

Meteor

Presider: Angelo Collins, *Vanderbilt University*

Small College Networking Ad Hoc Committee

Midnight Special

Presider: Katherine Norman, *University of Texas at Brownsville*; B. Patricia Patterson, *Wesley College*

Policy Advisory Committee

Texas Special

Presider: Barry Fraser, *Curtin University of Technology, Australia*

NARST Presentations at Other Professional Meetings Committee

Zephyr Rocket

Presider: Dorothy Gabel, *Indiana University*

8:30 AM — 10:00 AM General Session Wednesday, April 3, 1996

Discovering Discovery

Grand D,E,F

Presider: Thomas Kobaalla, Jr., *University of Georgia*
Presenter:
William Bechtel, *Washington University of St. Louis*

10:30 AM — 12:00 PM Strand Sessions Wednesday, April 3, 1996

Building a Pedagogical Content Knowledge Base for Elementary Science Teacher Education

Burlington Route

(D Teacher Education: Symposium)
Presider: Sandra Abell, *Purdue University*
Discussant: Kathleen Roth, *Michigan State University*
Participants:
Sandra K. Abell, *Purdue University*; Deborah C. Smith, *Michigan State University*; Julie A. Schmidt, *University of Deleware*; Shirley J. Magnusson, *University of Michigan*

Influences of Gender on Teaching and Learning in the Physical Sciences

Grand A

(F Cultural, Social and Gender Issues: Paper Set Grouped by Committee)
Presider: M. Jenice French, *Kansas State University*

Young Women and Physical Science: The History and Challenge of One Feminist Chemistry Teacher
Charles Jay Rop, *Michigan State University*

What is a Gender Sensitive Teacher?
Bambi L. Bailey, William J. Letts, IV, Kathyrn Scantlebury, *University of Delaware*

Physics For Girls and Boys: Teaching and Learning Strategies Examined in 25 Classes at Upper Secondary Level
Peter Labudde, Walter Herzog, Charlotte Gerber, Enrico Violi, *University of Bern, Switzerland*

Gender and Ethnicity: A Case for Writing-To-Learn Physics
Valora M. Johnson, *Georgia Institute of Technology*

Images of Change in Science Teaching and Learning: Exploring the Power of Video Case Studies in Teacher Education

Grand B

(D Teacher Education: Symposium)

Presider: Sue Mattson, *Harvard-Smithsonian Center for Astrophysics*

Discussant: Tom Dana, *Pennsylvania State University*

Participants:

Sue Mattson, *Harvard-Smithsonian Center for Astrophysics*; Terez Waldoch, *Wildwood Elementary School*; Pat Coleman, *Thurston Middle School*; Sharon Nichols, *University of Texas at Austin*; Tony Lorsbach, *University of Alabama, Huntsville*; Nancy Davis, *Florida State University*

Concept Mapping as a Tool to Promote Students' Science Understandings

Grand C

(D Teacher Education: Paper Set Grouped by Committee)

Presider: Joseph P. Riley, *University of Georgia*

Concept Mapping By Secondary Science Student Teachers on Science, Technology, and Pedagogy: Connections

Carolyn Dickman, *Radford University*; Meta Van Sickle, *University of Charleston*

An Exploratory Study of the Concept Map as a Tool to Facilitate the Externalization of Students' Understandings About Global Atmospheric Change in the Interview Setting

James A. Rye, *West Virginia University*; Pete Rubba, *Pennsylvania State University*

The Effectiveness of Concept Mapping and the Learning Cycle at Promoting Understanding of Diffusion and Osmosis Concepts

Louis Odom, *University of Missouri-Kansas City*; Paul Kelly, *Kansas City, MO*

The Effects of Combining Concept Mapping and Reflective Writing on Post-Secondary Students' Science Attitudes and Conceptual Understandings of Biology

Derrick R. Lavoie, *University of Northern Iowa*

The Preparation of Preservice Elementary Teachers in Science

Illinois Central

(D Teacher Education: Paper Set Grouped by Committee)

Presider: Mark Guy, *University of North Dakota*

Expertise in Elementary Science Teaching: Evaluating an Innovative Pre-Service Preparation Model

Gail Shroyer, Emmett L. Wright, Susan Kerr, Dan Kaur Weamer, *Kansas State University*

Qualitative Analysis of Preservice Elementary Teachers' Scientific Ways of Thinking, Attitudes and Perceptions During Collaborative Earth Science Field-Based Experiences

C. Kay Cooper, *KD Enterprises, Inc.*; Emmett L. Wright, *Kansas State University*

Elementary Science in Zimbabwe — Status of Process Skills In Teacher Training

E. M. Gwimbi, *University of Zimbabwe, Zimbabwe*; S. Mugandani, *Mkoba Teachers' College, Zimbabwe*

Oil and Water Don't Mix — What About Science and Language Arts?

Valarie L. Dickinson, *Oregon State University*

Authentic Problems, Projects and SMART Challenges: Support Structures that Increase Student Achievement

Frisco

(G Educational Technology: Invited Address)

Presider: Robert Sherwood, *VanderbiltUniversity*

Presenter:

John Bransford, *VanderbiltUniversity*

The Role of Assessment in Science Teaching and Learning

Jeffersonian

(B Learning: Classroom Contexts and Learner Characteristics: Paper Set Grouped by Committee)

Presider: David Deru, *University of Georgia*

Integrating Assessment and Instruction: An Elementary Classroom Example

Erica M. Brownstein, *Ohio State University*

The Effect of Anticipating Performance Assessment Tests on Learning Process Skills

Louise M. Baxter, *Central Washington University*

Dialogic Assessment Products: A View of Student Scientific Literacy in Action

Mark Templin, *University of Michigan*

Putting the New Standards into Practice: Needed Research — Regency A

(E Curriculum, Evaluation, and Assessment: Symposium)

Presider: Ronald D. Anderson, *University of Colorado*

Discussant: Richard A. Duschl, *Vanderbilt University*

Participants:

Ronald D. Anderson, *University of Colorado*; Ronald Good, *Louisiana State University*; Arthur L. White, *Ohio State University*

Factors that Affect Biology Teaching and Learning — Regency B

(B Learning: Classroom Contexts and Learner Characteristics: Paper Set Grouped by Committee)

Presider: Cheryl Mason, *San Diego State University*

"Why Don't They Just Tell Us What They Want Us to Know?"

Marcia K. Fetters, *University of North Carolina-Charlotte*

Interactions between Students and Instructors in Higher Education Biology Laboratories

Beatrice Hamilton, *Australian Catholic University*; John Wallace, *Curtin University of Technology, Australia*

A Beginning Biology Teacher's Knowledge of Students – A Case Study

Jong-Hsiang Yang, *National Taiwan Normal University, Republic of China*; I-Lin Wu, *National Taiwan Normal University, Republic of China*

Investigating the Disney Effect: Are Students Reluctant To Apply Natural Selection Principles to Life Forms with Which They Identify?

Murray Jensen, *General College, University of Minnesota*; John Settlage, Jr., *Cleveland State University*; A. Louis Odom, *University of Missouri-Kansas City*

Classroom Discourse — Regency C

(B Learning: Classroom Contexts and Learner Characteristics: Paper Set Grouped by Committee)

Presider: Nancy Brickhouse, *University of Delaware*

Classroom Discourse as Situated Achievement in a Grade 6/7 Unit on Simple Machines

Michelle K. McGinn, *Simon Fraser University*

Constraining the Learning of Science: Profiles of Power, Social Forces, and Discursive Capital.

Kenneth Tobin, *Florida State University*

Of Whirling Balls and Orbiting Spaceships: The Consistency of Students' Talk about Circular Motion within and between Different Contexts

Campbell J. McRobbie, *Queensland University of Technology, Australia*; Wolff-Michael Roth, *Simon Fraser University*; Keith B. Lucas, David Russell , Campbell McRobbie, *Queensland University of Technology, Australia*

Nets, Filters, and Glass Ceilings: Discourse and Knowledge Construction in the Science Classroom

Susan L. Westbrook, *North Carolina State University*

College Students' and Teachers' Understanding of the Nature of Science — Wabash Cannonball

(H History, Philosophy and Epistemology: Paper Set Grouped by Committee)

Presider: Christine Cunningham, *Cornell University*

Learning About the Nature of Science: The Model Ecosystem Project for Pre-Service Elementary Teachers

David C. Eichinger, *Purdue University*

Undergraduate Students' Understanding of the Nature of Science: Is Any Progress Being Made?

Randy Bell, Norman G. Lederman, *Oregon State University*

Baroque Tower on a Gothic Base: A Lakatosian Reconstruction of Students' and Teachers' Understanding of Structure of the Atom

Mansoor Niaz, *Universidad de Oriente, Venezuela*; Rafael Blanco, *Instituto Universitario de Tecnologia, Venezuela*

PART C
Abstracts

Edited by

Elizabeth Doster

Katherine Wieseman

William Veal

David Jackson

Denise Crockett

Abbas, Abdullah **Strand A** **Monday, April 1, 1996**
4:00 pm — 5:30 pm
Wabash Cannonball

An Alternative Approach in Science Learning: Active Learning Relating to the Concept of Motion in a Non-Science College Level Class

This study investigates alternative approaches to traditional styles of science learning in a required undergraduate class for non-science majors. The study focuses on the instructional strategies utilized, and seeks to explain their relationship to a teacher's beliefs about science learning and teaching. A methodology using interpretive and ethnographic research techniques was employed to determine the occurrence of active learning. Analysis of the research data strongly suggests that active learning was occurring in this class, and that students were stimulated to become more involved in the learning process. Creation of an environment for active learning requires more than one pedagogical strategy. In this science class, students used prior knowledge relating to motion to construct meanings in new contexts. Traditionally, relatively little emphasis is placed on understanding knowledge and its application in daily life. Therefore, this study may present an alternative way that students can actively learn through class interactions. In particular, the study provides interpretations about how students constructed meanings while learning about motion, and as such, becomes educationally significant.

Abell, Sandra K. **Strand D** **Wednesday, April 3, 1996**
10:30 am — 12:00 pm
Burlington Route

Building a Pedagogical Content Knowledge Base for Elementary Science Teacher Education

Deborah C. Smith **Julie A. Schmidt** **Shirley J. Magnusson**

The purpose of this symposium is to open a dialogue about knowledge needed by teacher educators for the preparation of elementary science teachers. Using Shulman's framework of pedagogical content knowledge, we describe our "wisdom of practice"--our ways of representing and formulating the subject matter of teaching teachers as well as our knowledge about our students' conceptions and beliefs about science content and teaching and learning science--derived through our own teaching of teachers. The symposium describes pedagogical content knowledge derived from four different elementary science methods courses. One course has been designed using the components of pedagogical content knowledge as a framework. Another is organized by a set of "lenses", including subject matter knowledge, pedagogical content knowledge, and assessment knowledge, to examine the nature of science teaching. A third course uses video cases to encourage preservice teacher thinking about science teaching and learning. The fourth course engages students in talking science as well as reading and writing about real people doing science in order to challenge their beliefs about science teaching and learning. The overall aim of the symposium is to build a community of science teacher educators committed to learning from their own practice of teaching future teachers.

Abraham, Michael R. **Strand G** **Monday, April 1, 1996**
2:45 pm — 3:45 pm
Grand D

The Use of Kinetic and Static Visuals in Organic Chemistry

Abdulwali H. Aldahmash

Using animated computer-generated graphics to assist instruction has recently attracted the attention of educators and educational researchers. The specific focus of this study was to compare the influence of animated visuals with static visuals upon college students' understanding of organic reaction mechanisms in chemistry. This study also focused on the relationship between students' achievement and spatial ability. The results indicate that students using animated visuals did significantly better than students using static visuals, which in turn did significantly better than a control group with respect to knowledge of organic reaction mechanisms.

Adams, Paul E. **Strand C** **Monday, April 1, 1996**
1:00 pm — 2:30 pm
Missouri Pacific

Beginning Science Teacher Cognition and Its Origins in the Preservice Secondary Science Teacher Program

Gerald H. Krockover

The objectives of this study were: 1) to identify the major tenets of a preservice secondary science education program as expressed by science and curriculum and instruction faculty; 2) to identify knowledge structures that beginning secondary science teachers have constructed about the teaching and learning of science; and 3) to identify the correlatives that exist between the first two objectives. The study was grounded in the postulates of teacher cognition in that teachers construct their own schema from their experiences in order to comprehend, plan for, and respond to the dynamics of their classroom. This qualitative study consisted of interviews and observations of beginning science teachers, and interviews with science and curriculum and instruction faculty and an analysis of the course syllabi of that faculty. Methods of single and cross-case analytic induction were combined to analyze the data. Based upon the data, it may be concluded that the program features of student-centered learning, cooperative learning, pedagogical knowledge, and pedagogical content knowledge were adopted into the schema of the beginning teachers; the degree of adoption appeared to be linked to an individual's most significant learning experience and the constraints of the school situation.

Agholor, Rose N. **Strand A** **Tuesday, April 2, 1996**
4:00 pm — 5:00 pm
Regency C

The Scientist in the Eyes of 13-Year-Olds in Nigeria

Peter A. O. Okebukola

This is a subset of an international study entitled 'Science and scientists: A cross-cultural comparison of children's interests, experiences, attitudes and perceptions that may be of relevance for Teaming science, with particular emphasis on gender aspects. The subjects for the study were 13 year-old students in junior and senior secondary schools in Lagos, Ogun, and Delta States of Nigeria. The main objective of this study was to find out what 13-year old students think about the scientist as a person. The sample comprised a total of 361 students made up of 214 girls and 147 boys. Two types of scientists were used, namely: the physicist (a person working with physics or engineering) and the biologist (a person working with biology or medicine). The students perceived the physicist or medical doctor as tidy, intelligent, imaginative/full of ideas, caring for others, hard working, fairly social, averagely interesting, and kind/humane. The item concerning whether this scientist is authoritarian/dominating or democratic, the students' views were somewhat evenly spread (37% for being authoritarian and 38% for being democratic). The data collected for the views of the students of the biologist or medical doctor indicate that these 13 year- olds perceived the scientist as tidy/neat, intelligent, imaginative/full of ideas, caring for others, very hard working, social/outgoing, interesting and exciting. For the item on being democratic or authoritarian, the students perceived the biologist as being slightly more democratic (42%) than authoritarian (31%). This positive image of the scientist is contrary to what research says about the image held by students from the western part of the world; however, it is in agreement with some previous findings by researchers in Nigeria when student attitudes about science were surveyed. The implications of the findings are discussed.

Aikenhead, Glen S. **Strand H** **Monday, April 1, 1996**
10:30 am — 12:00 pm
Burlington Route

Toward a Cross-Cultural Perspective on Western Students Learning Western Science: Border Crossings

Over the years constructivist science teaching has moved from an individual psychological perspective (personal constructivism), to sociological perspectives (social constructivism and situated cognition) and most recently to a worldview perspective. This paper proposes a broader framework: a cultural perspective from which learning conventional science becomes cultural assimilation into the subculture of Western science. A cultural perspective affords an intuitive holistic account of students' learning experiences in a science classroom by considering those experiences in terms of students crossing cultural borders from subcultures such as peers, family, media, and the school, into the subcultures of science and school science. For many Western students, the typical science lesson is experienced as a cross-cultural event. This paper argues that "science for all" requires educators to recognize, and to take into account, the cultural borders that students must cross before the science curriculum becomes accessible to them. The paper (1) describes cultures and subcultures, (2) provides a synopsis of research into the borders that students cross to learn science, (3) recognizes critical issues to be resolved, and (4) offers a new vantage point for understanding Western students learning science.

Akatugba, Ayo Harriet

Strand E **Tuesday, April 2, 1996**
10:30 am — 12:00 pm
Jeffersonian

The Cultural Contexts of Physics Students' Use of Proportional Reasoning in a Nonwestern Country

John Wallace

Proportional reasoning is important for students' success in the learning and understanding of physics concepts. However, students seem to have difficulty solving problems that involve proportional reasoning and some students are not using proportional reasoning. In spite of the various intervention measures, students still have difficulty with proportional reasoning which still remains an important requirement for successful problem solving in high science. Key aspects of students' difficulty with proportional reasoning can be understood only when the social and cultural contexts in which they are embedded are considered. Hence there is a need for a constructivist investigation of students' difficulty and non-use of proportional reasoning within their immediate cultural contexts. A qualitative and interpretive case study was carried out with five physics students from a co-educational senior secondary school to investigate the association between cultural heritage, African world view, authoritarianism, language, everyday life and students' use of proportional reasoning in physics. Students were engaged with various proportional reasoning tasks during which some multiple research techniques were employed to generate, analyze and interpret data using an emergent approach.

Alexander, Mary M. Cozean

Strand C **Monday, April 1, 1996**
4:00 pm — 5:30 pm
Missouri Pacific

This is Your Life: The Autobiography as an Integral Part of Praxis with Science Education Students

The research shared here is on the use of autobiography as a teaching and learning tool for students who will be tomorrow's science educators. The theoretical underpinning used in this study is that if we must use the cognitive domain to learn, changes in the affective domain naturally occur. The affective domain changes can be documented through the use of autobiography as a teaching and learning tool. The methodology that was used was a longitudinal single case study. The methods used in this study are transferable to other populations. A major finding is that not all individuals experience the same stage-changes a the same time; however, we all share the experience of self-change as we learn. The stage change patterns identified in this study are cyclical. We appear to go through our own learning patterns time after time. Recognition of the patterns we experience helps us become reflective prior to taking any new courses of action. This becomes preflexive praxis.

Allen, Nancy Jane

Strand E **Tuesday, April 2, 1996**
4:00 pm — 5:00 pm
Wabash Cannonball

"Give Value to Our Values": A Critical Theory Analysis of Community-Based Education for Native Americans

Frank E. Crawley

The purpose of this study was to evaluate the effectiveness of a summer institute in community-based education in helping science teachers create curriculum that was responsive to local priorities, values, indigenous ways of knowing, and life-world concerns. Teams composed of teachers, students, administrators and community members from six schools comprised the study population. The teams attended a two-week summer institute in which they received intensive training in culturally-inclusion methodology, environmental science content, constructivist pedagogy, and technology-enhanced instruction. Each team incorporated the model into a local community-based curriculum plan. After nine months, on-site visits to all teams provided qualitative data on the realization of the curriculum plans. Data was analyzed within a critical theory model. Results indicated significant differences among teams in the application and success of community-based science instruction. Teams which included administrators and non-teaching community members were more effective in implementing the curriculum plan, had more long-term viability, and were more responsive to community needs and values. Increased motivation and self-efficacy was reported for student participants.

Alters, Brian J.

Strand H

Tuesday, April 2, 1996
4:00 pm — 5:00 pm
New York Central

Whose Nature of Science?

Science education literature explicitly and/or implicitly advocates basic tenets (criteria) for "the nature of science." The purpose of this study was to investigate philosophers' of science views concerning some of these tenets. Philosophers of science expressed major disagreements with the tenets, and different philosophers of science varied on their views about the tenets. In addition, there is a relationship between philosophers' views of philosophy of space, their views on the nature of science, and their philosophy of science in general. Therefore, the tenets must be reconsidered so new criteria may be developed for future research.

Anamuah-Mensah, Jophus

Strand A

Tuesday, April 2, 1996
4:00 pm — 5:00 pm
Regency C

Chemistry Students' Perceptual Understanding of Chemical Species in Chemical Equation Balancing

The difficulties in perceptual understanding shown by chemistry students on chemical species involved in chemical equation balancing was studied among two groups of students. The groups consisted of those introduced to an innovative approach to teaching chemistry equation balancing and those who were not. Findings indicate that the prolonged use of the former resulted in a better perceptual understanding of chemistry equation balancing.

Anderson, Maria A.

Strand E

Tuesday, April 2, 1996
8:30 am — 10:30 am
Regency B

Understanding the Elementary Teacher: A Vital First Step in Science Education Reform

Elementary science education has been an enigma to reformers for the past 40 years. Researchers have virtually ignored the elementary teacher's voice in understanding why some elementary educators enjoy and effectively teach science while others do not. The purpose of this study was to answer the following questions: 1) What does it mean to be an elementary teacher? and 2) How do teachers' perceptions of teaching science correspond with their personal meanings of teaching at the elementary level? Two third grade teachers from a small rural public school were the participants of this study. By mutual agreement, one taught both classes science and the other taught social studies. Classroom observations, experiential anecdotes, audiotaped reflections, and informal interviews provided the data which forms the basis for each narrative case. Personal beliefs, goals, and personality traits directly influence how elementary teachers teach science. Science reformers must listen to classroom teachers, understand their reasons for becoming teachers, and utilize teachers' strengths to successfully accomplish elementary science education reform.

Anderson, Ronald D.

Strand E

Wednesday, April 3, 1996
10:30 am — 12:00 pm
Regency A

Putting the New Standards into Practice: Needed Research

Ronald Good   **Arthur L. White**

The new National Science Education Standards present a vision for science education which is a major departure from current practice in the schools. The extant research literature is missing answers to many of the questions of how best to get this new vision into classroom practice. The purpose of this symposium is to identify research with the greatest promise of answering these questions. Attention will be given to both the research questions and methodologies with potential for answering them. Appropriate research has the potential of filling some of these gaps and providing a basis for implementation efforts that lead to significant reform. There is a need for research based on many orientations including psychological, philosophical, socio- cultural and subject-matter perspectives. The intent of the symposium is to develop a case for particular kinds of research, not just present a "laundry list" of research topics, and provide an opportunity for discussion of the issues by both the panelists and the audience.

BEST COPY AVAILABLE

Appleton, Ken

Strand A **Tuesday, April 2, 1996**
2:30 pm — 3:30 pm
Grand B

Students' Responses During Discrepant Event Science Lessons

This study explored the cognitive responses of students to science lessons incorporating discrepant events. Three pedagogically different teaching strategies using the same discrepant event were taught to six upper elementary classes. Case studies describing eighteen students' cognitive responses during the lessons were constructed from video tapes of the lessons, stimulated recall interviews with the students, and field notes. A common set of cognitive responses was identified for most students for all three teaching strategies. A small number of responses seemed to be student-dependent. However, the teaching strategy also seemed to influence the responses used by students, in that some types of responses were encouraged by a particular teaching strategy, and the use of other responses was inhibited by a particular teaching strategy. The results provide some indications as to how a more effective teaching strategy might be developed which increases the number and range of cognitive responses used by students.

Arambula Greenfield, Teresa

Strand D **Monday, April 1, 1996**
8:30 am — 10:00 am
Wabash Cannonball

A Collaborative Science/Education Teacher Staff Development Program

Arnold Feldman

A semester-long program to enhance the science knowledge and pedagogical skills of teachers of grades K-8 was co-developed and co-implemented by two university faculty members, one from the College of Natural Sciences (Physics) and one from the College of Education (Curriculum & Instruction). Teachers participated in physics and chemistry activities structured within a context of teaching strategies selected to both maximize student hands-on, active learning and to encourage full participation by both sexes. Project instructors worked with teacher groups to develop teaching lessons, which teachers implemented between sessions; subsequently teachers shared their experiences and received feedback. The project was evaluated using pre- and post-project instruments administered to both project and control-group classes; these included student science tests, student and teacher surveys, and classroom observations. Results indicated that teachers valued all program aspects, particularly collaborative lesson planning/review and equity information. Newer teachers demonstrated the greatest behavioral changes. Student achievement did not change significantly but student attitudes towards science became more favorable.

Arteaga, Cecilia Ceuvas

Strand I **Tuesday, April 2, 1996**
8:30 am — 10:00 am
Frisco

Evaluación de Resultados de un Curso de Actualización Dirigiso a un Grupo Interdisciplinario

La Facultad de Ciencias Químicas e Ingeniería llevó a cabo el curso en Contaminación e Impacto Ambiental, ofrecido a 40 estudiantes licenciados en Ingeniería, biología, o química. El objetivo de este estudio es evaluar los resultados del curso. Dicha evaluación se enfocó en cinco aspectos: cumplimiento de objetivos, desempeño de profesores, estructuración de exámenes y proyecto final, logros y satisfacción de expectativas, y motivación para continuar estudios en la misma área. Se planteó una encuesta con preguntas claves agrupadas para responder a cada aspecto en cuestión, y se aplico a los estudiantes. Los resultados mostraron satisfaccion en objetivos y logros alcanzados. La selección de profesores fue adecuada basándose en nivel académico y experiencia profesional. Se observó que el tipo de examen teórico, y la presentación verbal de proyectos no es significativo para los estudiantes, prefiriendo una mayor práctica (aplicación del conocimiento en la solución de problemas reales), y se logró motivar al grupo para continuar sus estudios mediante cursos de especialización que tienen por objetivo profundizar en una temática específica ya vista en forma general en el curso aquí evaluado.

Atwater, Mary M.

Strand H **Monday, April 1, 1996**
10:30 am — 12:00 pm
Burlington Route

A World View of Education: Through the Eyes of Ethnicity and Culture

Denise Crockett

The purpose of this study was to explore the relationship between preservice science teachers' world view of education and their perception of ethnic and cultural identities. The answers to the following questions were sought: 1. How are ethnicity and culture described by the preservice science teachers?; 2. What do they perceive to be their ethnic and cultural identities?; 3. How have their experiences impacted on the students' world view of education? This collective case study included interviews of three male students pursuing master's degrees in science education. The study was designed using a Vee diagram. A semi-structured interview protocol was developed and consisted of 12 questions. Some questions were open-ended to discover important categories, dimensions, and interrelationships. These three male preservice science teachers had similar world views about education. Their world views were influence by the constructs of class, ethnicity and culture, and religion. Their earlier life experiences continue to have a profound effect on their world view of education; however, their schooling experiences at colleges and universities have provided them opportunities to interact with students from ethnic and cultural backgrounds different from their own.

Bailey, Bambi L.

Strand F **Wednesday, April 3, 1996**
10:30 am — 12:00 pm
Grand A

What is a Gender Sensitive Teacher?

William J. Letts, IV Kathyrn Scantlebury

As part of a larger project, four secondary science teachers' classes were observed. Quantitative and qualitative data were gathered via observations, interviews, and surveys to ascertain whether each teacher could be considered a "gender sensitive" teacher. Gender sensitive teachers would take gender into consideration when it matters and ignore it when it does not (Martin, 1991). The data was triangulated and resulted in four profiles. Each was compared to a list of "gender sensitive indicators" prepared by the research team. A major question raised by the data is, "Considering that the gender sensitive indicators are ideals, at what point does one consider a teacher to be gender sensitive?" This session will examine the data gathered so far and our interpretations as well as discuss how to qualify or quantify an entity like gender sensitivity. Many novice teachers teach as they were taught or as their cooperating teacher taught during the student teaching practicum. Those individuals generally chosen to be cooperating teachers, probably finished their education prior to the surge of research on equity (Jayne, 1987; Scantlebury, 1990). Therefore, through no fault of their own, these master teachers may have continued to model inequitable science teaching strategies to their students and student teachers. Considering that, it is not surprising that inequitable teaching strategies are still often reproduced despite emphases on equity in some science methods courses. If inservice science teachers begin teaching their students equitably, such strategies may be more acceptable to those students who decide to go into teaching. If preservice science teachers have equitable teaching strategies modeled for them in their methods course and field observations and are encouraged to use those strategies during their student teaching practicum, they may find the use of such strategies more natural when they begin inservice teaching.

Barrow, Lloyd H.

Strand C **Monday, April 1, 1996**
1:00 pm — 2:30 pm
Missouri Pacific

What are the Science Needs of Beginning K-12 Science Teachers in Missouri?

Donna Plummer

The purpose of this study was to analyze the types of requests of beginning K-12 science teachers via an intrastate hotline. A total of 456 requests were received over a 3.5 year period. The greatest users of the service were teachers of smaller school districts. The most frequent was for suggestions to increase hands-on learning opportunities rather than classroom management concerns that had been reported in the literature.

Barufaldi, James P.

Strand D **Tuesday, April 2, 1996**
10:30 am — 12:00 pm
Illinois Central

Scaling Up Regional Collaborative Activities: Assessment and Disseminatic Strategies

The Regional Collaboratives for Excellence in Science Teaching presently include twenty collaborative projects throughout the state of Texas. Future plans include adding additional collaboratives, improving and expanding collaboration processes, and enhancing staff development programs that are offered through the Regional Collaboratives. Evaluation activities will be expanded and will continue to include needs assessments, and both formative and summative evaluations of the Regional Collaboratives, the structure and function of the collaboration processes, and the staff development programs for teachers. Continued emphases will be placed on involving both education and science faculty, teachers from traditionally underrepresented groups, school district administrators and education service center leaders, as well as business and community representatives. Assessments of Collaboratives address the extent to which these goals and the other goals of the Texas Regional Collaboratives have been achieved. Evaluation designs of each individual Collaborative assess the effectiveness of the professional development program and its impact on teacher performance and student achievement. The impact on teacher performance is assessed by measuring (a) changes in teacher knowledge and attitudes with regard to science content and teaching methodologies and (b) self-evaluation and reflections of teachers. Results of example Regional Collaborative evaluations, as well as strategies for dissemination of processes and outcomes, will be presented during this session.

Baxter, Louise M.

Strand E **Wednesday, April 3, 1996**
10:30 am — 12:00 pm
Jeffersonian

The Effect of Anticipating Performance Assessment Tests on Learning Process Skills

The purpose of this study was to determine if college biology students who anticipate being administered laboratory performance assessment tests will perform better than biology students who anticipate short answer tests when tested using "thought exercise" which require them to understand process skills. Students were administered tests weekly at the beginning of their laboratory activities. For two weeks control groups were led to anticipate short answer tests; test groups were led to anticipate performance assessment tests. Both were then administered a multiple choice, thought exercise test, requiring (a) understanding and transfer of process skills and (b) content knowledge. The three week regime was then repeated, and a follow-up test administered at the end of 11 weeks. Results indicate that students who anticipate performance assessment tests score significantly better on process skill questions when these questions do not require far transfer of understanding; they do not score better on content knowledge. Audiotaped group discussions also indicated higher-level discussion occurring amongst students anticipating performance assessment tests. The implication is that administering repeated performance assessment tests appears to cause students to alter their learning strategies such that they learn process skills during laboratory work.

Beeth, Michael

Strand A **Monday, April 1, 1996**
1:00 pm — 2:30 pm
Jeffersonian

Teaching for Understanding in Science: What Counts as Conceptual Change?

Sister M Gertrude Hennessey

The purpose of this study was to document the existence and role of one cognitive and two metacognitive constructs on students' abilities to learn and understand new science concepts. Comments directly related to science concepts, metacognitive comments concerning the status of concepts, and comments indicating the limitations or extent of a conception were documented. Approximately sixty students, half in a High School science class and half in sixth grade science class, were exposed to instructional activities that elicited their thoughts and beliefs about science concepts. Teachers in both classrooms elicited students' metacognitive thoughts about the science content they were studying. Analysis of whole class discourse and individual student interviews were used to document the impact of each form of conceptual change on the student's ability to understand science concepts and their ability to think about their science concepts. Results of this study indicate that all students were able to engage in at least one form of conceptual change, and that those students engaged in all three forms were more like to experience change in their science conceptions.

Beilby, Jerry P.

Strand B **Monday, April 1, 1996**
2:45 pm — 3:45 pm
Regency A

Structured Controversy as a Strategy for Conceptual Change in Environmental Science

Fred N. Finley

The purpose of this study was to evaluate the effect of structured controversy on the learning and use of ten targeted ecological concepts. Structured controversy is a debate- styled instructional strategy that was used to enhance cognitive processing of concepts by challenging opposite viewpoints on the continued use of pesticides. Forty-eight students in a college environmental science course were placed in heterogeneous groups of four. The groups were randomly assigned to the treatment or individual study (control) groups. In a pre- and post-treatment written assessment, the students individually generated a series of propositional statements that they used to support a decision on an ecological problem. The change in the number and quality (correct, incorrect, and vague) of the propositions was compared between the structured controversy and individual study groups. No significant differences were observed for targeted ecological concepts. However, there was a significant difference between groups that favored the experimental group with respect to their use of socially relevant statements. This change in the use of socially relevant topics in a science course was an unexpected outcome.

Bell, Randy

Strand H **Wednesday, April 3, 1996**
10:30 am — 12:00 pm
Wabash Cannonball

Undergraduate Students' Understanding of the Nature of Science: Is Any Progress Being Made?

Norman G. Lederman

The study's purposes were to (1) assess undergraduate non-science majors' understandings of the nature of science, (2) compare non-science majors' understandings of science to those of science majors, (3) describe the relationship between the number of science credits completed and students' understandings of science. The sample consisted of 510 predominantly non-science major students enrolled in a junior-level geology course. Understandings of the nature of science were assessed by the Conceptions of Scientific Theories (COST) instrument and a four-item, open-ended questionnaire. Students were pretested the first week of class and posttested the final week with both instruments. Neither science majors nor non-science majors made significant gains on either instrument. Comparison of the pretest scores revealed significant differences in favor of the non-science majors on the "Generation of Theories" subscale and the total COST scores; however, these differences were too small to be of practical significance. The correlation of the number of science courses completed vs. COST total pretest score revealed no significant relationship. Chi-square analysis indicated no significant differences between science majors' and non-majors' frequency of responses categorized as "tentative."

Bellamy, Mary Louise

Strand D **Monday, April 1, 1996**
1:00 pm — 2:30 pm
Illinois Central

"How Can You Know?" in the High School Laboratory: An Application of the Shoestring Biology Labs

The evaluation study of the Shoestring Biology Laboratory Investigations was designed to answer the question, did these investigation make a difference in the teaching and learning of biology in the high school science classroom? Further, in what ways were these classrooms and students impacted by their use? In addition to the usefulness of the topics of the laboratory investigations, the students clearly enjoyed the opportunity to ask questions and to design their own experiments. The quiz results showed that the more the students had practice finding evidence for answers to questions they had posed, the better their problem solving skills became. As seen in the results from the control group students, lacking these kinds of laboratory experiences, exposure to biology does not itself help students to solve problems. If problem solving is a valued outcome of high school biology, then the Shoestring Biological Laboratory Investigations provide evidence that learning how to think or problem solving can be achieved by high school students. This tool helped their students achieve what for many years has been described as the primary goal for teacher science -- that is, learning how to solve problems and think critically.

Belzer, Sharolyn J.

Strand G

Monday, April 1, 1996
10:30 am — 12:00 pm
Wabash Cannonball

Relating Differential Strategy Use of Hypermedia to the Detection of Exceptional Achievement in Learning Science

George Estabrook

"BioMap", a hypermedia application, was developed by the author and others to facilitate learning of evolution by reducing misconceptions, and record how students used BioMap. The purpose of the study was to investigate two questions: 1) Do all students who use BioMap achieve/learn its' content? 2) Is it possible to identify strategies that are predictive of achievement/learning? Twenty-six undergraduates enrolled in a nine week mini-course, using BioMap for 24-36 hours. A mini-test for content knowledge was administered. "Trail maps were generated as students used BioMap. Innovative techniques were employed to analyze data. Mini-tests were analyzed using: repeated ANOVAs, a novel approach called computationally intensive inference making, and frequencies of conception/misconception. Sample size limits the extent to which conclusions can be drawn from this study. Tentative conclusions include: 1) Students demonstrated significant gains in understanding. 2) Misconception frequencies were reduced significantly for most students. 3) Stable/unstable, and malleable/resistant conceptions were identified. 4) How students used reading in BioMap contributed to achievement/learning differentials between students. This study is one of only a few that integrate what students learn with how they learn. Findings should guide: 1) science educators and instructors in instructional reform, and 2) software designers in development and classroom implementation.

Berger, Carl F.

Strand G

Monday, April 1, 1996
2:45 pm — 3:45 pm
Frisco

Students' Use of Concept Maps to Guide Multimedia Science Instruction

Tricia Jones **Neil Skov**

The purpose of this study was to analyze students use of concept maps to guide a microcomputer supported chemistry instructional program. A multimedia interactive software package was used as the learning environment. The package contained screens of information in text and picture form, animation, simulation, video segments, focus questions, inquiry questions and an organizing concept map. Students could navigate by clicking on icons that initiated the next event or state of learning. Accessible at all times was a concept map, instructor generated, that students could use to assist in their navigation and study. To what extent did students use concepts maps to navigate and/or to extend their knowledge of the subject matter? Data were gathered automatically in log files for over 400 students. Students used concept maps from 9 to 226 times with a median of 70 uses. Students spent from 2 to 58 minutes (almost an hour) with a median of 17 minutes on the maps of the six modules. Results indicated that students varied widely in using the concept maps and the used them for both navigation and study of the subject matter.

Berlin, Donna F.

Strand D

Monday, April 1, 1996
2:45 pm — 3:45 pm
Missouri Pacific

Coordinating and Supporting Teacher Research within a School District

John J. Smith **Arthur L. White** **Gene Hungate**

The purpose of this study was to describe and analyze the tasks, roles, support, and control in a collaborative action research group of five teachers in one school district, a central office administrator, a college teacher educator, and two university researchers. Each of the five elementary teachers designed and conducted action research related to activity-based science learning in her/his classroom. The other research group members supported the teacher-researchers in their research through workshops, meetings, and site visits. Sources of data were field notes, interviews, semantic differentials, and minutes of meetings. From those data sources, the authors (a) identify five basic tasks for coordinating an action research program within a school district; (b) outline the major roles of the participants; (c) describe five categories of support provided to the teacher-researchers; (d) analyze the decision-making processes in the action research program; and (e) propose ways to sustain action research within the district in the future.

BEST COPY AVAILABLE

Berlin, Donna F.

Strand D

Monday, April 1, 1996
1:00 pm — 2:30 pm
Grand C

A Longitudinal Study of an Action Research Program: Implications for Educational Innovation and Professional Development

Arthur L. White

An Action Research Program has been implemented for five years as a collaboration between inservice teachers and teacher education faculty. This year-long program was designed to prepare and support teachers in the development, implementation, and evaluation of innovation within their classroom. The purpose of this study was to investigate 1) the attitudes and perceptions of classroom teachers related to educational innovations and educational research and 2) the relationship between action research experience and professional development. Data sources included a pre and post 15-item semantic differential, open-ended questionnaires, taped teacher presentations/discussions of projects, and follow-up questionnaires. Based upon both quantitative and qualitative data analyses, the results suggest that this action research program (a) enhances teacher attitudes toward educational research; (b) promotes realistic perceptions related to educational research; (c) fosters positive dispositions toward educational innovations; (d) increases teacher involvement in local, state, and national professional activities; (e) facilitates the implementation of educational innovations and improved teaching and learning in individual classrooms; (f) changes the participating teachers' views of their classroom roles to include reflection and inquiry; and (g) stimulates academic collaborations within school buildings, across school districts, and with university and business partners.

Berrnier, Norma E.

Strand D

Tuesday, April 2, 1996
4:00 pm — 5:00 pm
Regency C

Attitudinal Factors That Influence Preservice Elementary Teachers' Concentration Selection

The purpose of this study was to compare beliefs, values and attitudes of preservice elementary teachers who had selected a science or a non-science area of concentration. The study population was 33 science and non-science preservice elementary teachers who took required and optional science courses in their Teacher Education program at Indiana University. Each science course (S406, Q200, Q201 and Q202) corresponded to a different stage in their program. Structured interviews were conducted to collect the data. The sequence and wording of the questions were determined ahead of time in a pilot study. Participants were asked about their parents' views and school science experiences at different school levels. Results indicated that science preservice teachers had more positive (93%) attitudes, values and beliefs toward their science area of concentration than non-science preservice teachers (50%) had about their concentration. Science preservice elementary teachers' positive high school and college science experiences, science teachers, and hands-on classes may account for these results. Also, science preservice teachers had stronger positive beliefs, values and attitudes toward their elementary teaching goal (93%) than their non-science counterparts (78%).

Bianchini, Julie A.

Strand E

Tuesday, April 2, 1996
8:30 am — 10:00 am
Regency B

Entering the National Reform Fray: An OECD Case Study of Project 2061

Nicole I. Holthuis

This paper highlights one story described in the OECD case study of Project 2061: the content, development, dissemination, and implementation of the project's most recent publication, Benchmarks for Science Literacy. Benchmarks identifies what all students should know and be able to do in science, mathematics, and technology by the end of grades 2, 5, 8, and 12. Through analysis of documents, field notes, and interviews, we explore the following questions about Benchmarks: How does the form and substance of Benchmarks provide insight into the project's conception of science, teaching, and learning? How does the document's history highlight ways in which project participants have shaped and been influenced by other science education reform efforts? What challenges and benefits arise from involving local teachers in the development of a national document? How can the lessons learned in disseminating and implementing Benchmarks serve to inform other reform efforts? We suggest that Benchmarks exemplifies the project's capacity to frame the national educational agenda and make significant contributions to it. In addition, it reflects the project's ability to remain flexible in light of changing internal and external demands. Finally, the project's experiences with Benchmarks offer lessons to other reform efforts, particularly the national science standards.

Birsner, E. Diane

Strand D

Monday, April 1, 1996
8:30 am — 10:00 am
Wabash Cannonball

An Ecofeminist Perspective of a Case Study Involving the Status of Inservice Teacher Staff Development for Environmental Education in Texas

The purpose of this paper is to critique the traditional approach to the environmental education (EE) teacher inservice staff development delivery system from an ecofeminist perspective within the context of a case study. The traditional approach is defined as the use of mechanistic, hierarchical methods of delivering EE inservice training in which the teacher is regarded as a passive learner. In contrast, the ecofeminist approach views the teacher as an active participant engaged in the design of her own socially critical curriculum. The case study involved accumulating baseline data of state-supported EE teacher inservice staff development efforts in Texas. I analyzed the data qualitatively and to a lesser extent quantitatively, and determined that the state-sanctioned inservice delivery system was traditional in scope. I argued that to empower teachers and subsequently their students to change the sociopolitical practices that have led to our current environmental problems, we must first redefine environmental education from an ecofeminist perspective which will then support a socially critical teacher inservice EE delivery system.

Bitner, Betty L.

Strand C

Tuesday, April 2, 1996
2:30 pm — 3:30 pm
Regency C

Interactions Between Hemisphericity, Learning Type, and Concept Mapping Attributes of Preservice and Inservice Teachers

Farella L. Shaka

The purpose of this study was to determine whether hemisphericity and learning type are related to concept mapping attributes of preservice and inservice teachers. Also, differences in concept mapping by program (i.e., preservice elementary/middle school and secondary science teachers and inservice elementary/middle school teachers), learning type, and hemisphericity were investigated. Hemisphericity and learning type were measured by the Hemispheric Mode Indicator and 4MAT Learning Type Measure, respectively. Concept maps were constructed by the teachers and scored on a seven attribute rubric. Statistically significant intercorrelations were found between hemisphericity and learning type as well as between the attributes within the concept maps. However, concept mapping attributes did not correlate significantly with hemisphericity and learning type. The ANOVA analysis indicated that the inservice elementary/middle school teachers performed significantly better in concept mapping than the preservice elementary/middle school and secondary science teachers.

Black, Kathie M.

Strand D

Tuesday, April 2, 1996
10:30 am — 12:00 pm
Grand B

What Works and What Doesn't: An Examination of Earth Science Content Courses for Pre-Service Elementary Teachers

This study involved interpretation of current reform literature on the importance of modeling rigorous science content for pre-service elementary education students. This study utilized a self study of five intact sections of a pre-service science foundation course over two academic years. Quantitative aspects of the study were based on a quasi-experimental pre-post testing of science knowledge in four of the five sections taught. Qualitative aspects in the study were based on student evaluations of the course and instructional activities. Subjects involved with this study were first and second year students planning to major in elementary education at the University of Victoria, British Columbia, Canada. There was a total of 116 students involved in the overall study. Of the four sections of SNSC 145B that were pre-post tested, each section demonstrated a significant change in content knowledge. Ratings from course evaluations also showed marked improvement of the course over time. Student comments indicate that students expected a rather traditional lecture-laboratory approach for post-secondary science courses.

Boberg, Wesley S.

Strand C

Tuesday, April 2, 1996
10:30 am — 12:00 pm
Missouri Pacific

Preservice Elementary Teachers: Their Science Content Knowledge, Pedagogical Knowledge, and Pedagogical Content Knowledge

Carrie J. Gee

The purpose of this study was to examine the level of elementary education majors' science content knowledge, pedagogical knowledge, and pedagogical content knowledge prior to and during their student teaching. The study was conducted as part of the evaluation of a new teacher preparation program for undergraduate students with a science area of concentration, developed through the Quality University Elementary Science Teaching (QUEST) Project at Indiana University. The subjects of the first phase of the investigation were: a) 24 seniors with the science area of concentration; and b) 25 seniors with areas of concentration other than science. The subjects of the study's second phase were 9 student teachers (6 QUEST, 3 nonQUEST) who had participated in the first phase. Aspects of each type of knowledge that were specifically addressed in the teacher education program were examined. Quantitative and qualitative data sources included observations, free-response tasks and surveys, and document collection. Although the results showed few overall differences between groups, the QUEST students consistently expressed and displayed more confidence in their abilities to teach science to children.

Bolte, Claus

Strand B

Monday, April 1, 1996
2:45 pm — 3:45 pm
Grand B

Aspects of Science Instruction in the View of German Junior High School Students: Conception and Application of the Computer-Assisted Procedure for the Analysis of Motivational Learning Climate Issues in Biology, Chemistry and Physics Instruction

One aim of our study was to develop and improve special versions of a questionnaire designed to investigate biology, chemistry and physics instruction. We sought to develop questionnries which were theoretically sound, highly practical, easy to handle, as well as supplying teachers and researchers with extensive and interesting information about motivational aspects of the learning climate in their science classes. The items of our questionnaires focus on seven learning climate indicators (comprehensibility/requirements, general content of a specific science subject, relevance of a science subject's content, opportunities to participate, class cooperation, students' willingness to participate and students' satisfaction). In four investigation periods the different questionnaires were administered to more than 4000 students and more than 150 science teachers at German high schools in order to investigate a number of issues. Special computer-programs allowed a very economical data-registration and analysis. The analyses demonstrate that all questionnaires are theoretically sound. With the help of our instruments, researchers as well as teachers can gain insight into selected aspects of science instruction.

Boone, William J.

Strand G

Monday, April 1, 1996
1:00 pm — 2:30 pm
Frisco

Interactive Video Technology and Hands-On Science

Two-way audio/two-way video technology was utilized to teach a semester long hands-on science course to teachers of a large metropolitan region. The broadcasts took place once a week for two hours. During each broadcast the studio could interact with three different school sites. Each of the 2 hour broadcasts were recorded and evaluated. Qualitative analysis indicated a range of attentiveness on the part of participating teachers. Quantitative analysis revealed that although each of the three schools was visited by the instructors a comparable number of times, more discussion took place with the school site that was very involved in lessons, and the school site that was uninvolved. The one site that had teachers who attended to the activities, but was not particularly active was given less time by the studio instructors. A variety of teaching techniques transfer to a distance education science classroom, however, many do not. This study provides an important view of the way in which studios and sites behave when a hands-on science curriculum is provided with this interactive technology.

BouJaoude, Saouma

Strand A

Tuesday, April 2, 1996
8:30 am — 10:00 am
Jeffersonian

Sociology and Epistemology of Science According to Lebanese Educators, University Students, and High School Students

The purpose of this study was to assess the beliefs of science university professors and students and high school teachers and students about the sociology and epistemology of science. Subjects for this study were 24 science university professors, 124 science teachers, 118 science university students, and 572 high school students from universities and schools in Lebanon. Participants in the study filled out a questionnaire comprised of 15 items selected from three components (science and technology, social construction of scientific knowledge, and nature of scientific knowledge) of the Views of Science - Technology - Society (VOSTS). Results indicated that most Lebanese university professors, high school teachers, university students, and high school students subscribe to a traditional view of science. The findings of this study, together with previous findings with Lebanese middle school students, provide support to the notion of a culture of academic science that permeates the educational system in Lebanon.

Bowen, Craig W.

Strand E

Tuesday, April 2, 1996
10:30 am — 12:00 pm
Grand A

Assessing Student Learning in Chemistry: A Demonstration of Task Format Affecting Student Thinking

Jennifer Prinkey   Gayle Mize

This study investigated strategies used by science majors to solve chemistry problems posed in paper-and-pencil and video-demonstration formats. Think-aloud interviews were conducted in which subjects were asked to solve eight problems (four presented via pencil-and-paper, and four in a video format). Transcripts of the 16 interviews with college chemistry students were analyzed to detect student conceptions (or misconceptions) and problem-solving strategies. A scheme consisting of 47 coding categories was developed for analyzing the interview tasks responses. Chi-square analysis indicated that in 13 of the 47 coding categories that there were significant differences between the proportion of times a particular behavior was exhibited as a function of task format. For example, one coding category showed that for two of the eight items, students answering the tasks in a video format provided accurate answers more frequently than the students answering the same question in a paper-and-pencil format. Such work demonstrates that assessment-of-learning techniques (in this case paper-and-pencil or video-based) constrain what students are able to do in terms of explaining chemical phenomena. This means that although students may not be able to give symbolic-level explanations of chemical phenomena, they may be able to explain chemical phenomena at a macroscopic level.

Bowen, G. Michael

Strand B

Tuesday, April 2, 1996
2:30 pm — 3:30 pm
Regency A

Performance and Confidence on Science Tests: Quantitative and Qualitative Relationships

Michelle McGinn

This study was conducted to assess the calibration abilities (confidence related to actual performance) of high school Human Anatomy students on different types of questions given them on tests and exams over the school year. The fifty-five students involved indicated on several of their tests over the school year, using a 5-point Likert scale ranging from "Not at all confident" to "Completely confident," how confident they were in the correctness of the answer given for each question. A learning style survey was given at the beginning and end of the school year, as was a questionnaire to determine general demographic information at the end of the year. Interviews were conducted with thirty students at the end of the year discussing (1) study skills and confidence in test taking, and/or (2) students specific studying methods and confidence ratings for the test they had just written. Test questions were classified into "types" according to complexity, and relationships between complexity and success examined. Student confidence as affected by study methods and time spent was compared with calibration abilities. Confidence was related more to study time than study quality. Higher achieving students preferred answering higher order questions despite being confident on lower order ones.

Bowman, Jacqueline K.

Strand A **Tuesday, April 2, 1996**
4:00 pm — 5:00 pm
Burlington Route

The Use of Mnemonics in Constructivist Teaching of Chemistry

This study examines the effectiveness of using mnemonics with constructivist teaching practices. Three curricula were designed for teaching the concept of the mole. One curriculum used constructivist teaching, one used traditional teaching with mnemonics, and one used a combination. The objectives were (1) to determine whether constructivist teaching could be combined with mnemonics; (2) to examine the effects of gender ; (3) to examine the effect of prior chemistry ability on student learning; and (4) to examine how student attitudes toward science were affected. Student attitudes and student understanding were examined using a pre- and post-test. Retention of understanding was examined by a second post-test taken 5 months after the original post-test. Students were also observed and interviewed during the study. Important findings include (1) students in the constructivist-mnemonic classes had a better understanding of the mole; (2) students in the constructivist classes had less confidence in their understanding of the mole; (3) students with high prior chemistry ability using the constructivist-mnemonic method achieved significantly higher scores; and (4) female students in the constructivist-mnemonic and mnemonic groups retained significantly less knowledge of the concept of the mole than male students in the same groups.

Breen, Timothy J.

Strand E **Tuesday, April 2, 1996**
4:00 pm — 5:00 pm
Regency A

Alternative Assessment in Secondary Science Classrooms: A Content Validity Study of Student-Constructed Artifacts

Joseph S. Krajcik

Current science education reform efforts focus on students learning complex ideas in authentic situations. One challenge of the new reform efforts is the development of appropriate assessment methods. This study explores the content validity of student-constructed "artifacts" such as project reports, physical models, and HyperCard stacks. The main question posed is: How well do artifacts represent student content understanding? Data were collected in four ninth grade science classrooms where students carried out authentic investigations about their local environment lasting from four to six weeks. Group artifacts, as well as individual concept maps, tests and content interviews were collected from 24 students for each of two science projects. This study took an interpretive approach to content validity, building a picture of student understanding by following tracer concepts through various assessments (concept maps, tests, and content interviews) and comparing this representation of their understanding with that demonstrated in the artifact. Study results suggest that artifacts can be particularly good representations of student understanding of the connections among concepts. However, results also suggest that this can easily be subverted by poorly designed artifacts tasks.

Brickhouse, Nancy W.

Strand H **Monday, April 1, 1996**
8:30 am — 10:00 am
New York Central

The Problem of Dogmatism in Science Education

William J. Letts, IV **Aletha Ramseur** **Michael J. Smith**

While school science continues to be regarded by students as important for getting into college, getting a good job, etc.. there are also surveys that document that some of the basic tenets of science are not believed by many people. Perhaps scientists and science educators have unwittingly participated in the demise of the credibility of science by portraying science in school in ways that are both inaccurate and unbelievable. We will present case studies of two different scientific theories that constitute a significant portion of the school science curriculum: plate tectonics and evolution. These theories were also selected because the are the major organizing theory of their respective disciplines. Yet they also have some empirical problems. We will begin by giving a brief overview of the historical development of the theories, the reasons for its acceptance by the scientific community, and the empirical problems that remain unsolved. We will then examine how these ideas are presented in textbooks and compare this presentation to our own historical account. Finally we will discuss the implications of our findings for educational practice.

84

Brophy, Sean P.

Strand G **Monday, April 1, 1996**
8:30 am — 10:00 am
Frisco

Computer Tools to Facilitate Problem Understanding of Video Based Anchors

Problem based learning utilizes rich contexts to provide links to many concepts and ideas. Video based anchor stories represent on presentation method that has proven to effective and motivating for young science explorer. The contexts created in these video are complex and require time to explore. Therefore, the teacher and students need a method to maintain their progress. The object of this paper is to introduce two computer tools used to manage and assist with the acquisition of this large amount information presented in the video based problems in an effort to understand the problem. The first tool is a Computer Mediate Instructional (CMI) environment which poses problems in a video format and allows students to interact with the video to understand the problem before attempting to solve it. The second computer tool is designed to facilitate students exploration of large macrocontext. Once organized they can use this index to systematically explore each of the facets of the macrocontext.

Brown, Fletcher S.

Strand D **Tuesday, April 2, 1996**
2:30 pm — 3:30 pm
Wabash Cannonball

The Effect of an Inquiry-Oriented Environmental Science Course on Preservice Elementary Teachers' Attitudes About Science

The purpose of this study was to assess the effects of an inquiry-oriented environmental science course on preservice elementary teachers' attitudes about science. Preservice elementary teachers taking a required semester-long environmental science course were given the actual form of the Science Laboratory Environment Inventory and the Test of Science Related Attitudes questionnaire. Pre and post scores were analyzed for any significant change. Results suggest that an inquiry-oriented environmental science course had a positive effect on preservice students' attitudes regarding the social benefits and problems which accompany scientific progress.

Brownstein, Erica M.

Strand B **Wednesday, April 3, 1996**
10:30 am — 12:00 pm
Jeffersonian

Integrating Assessment and Instruction: An Elementary Classroom Example

This research examines a teacher assessing her students and how that knowledge impacts her classroom decision-making using a participant observation case study methodology. The classroom was observed and video-taped twice a week for the first semester. Notes made during the observations and were used to conduct interviews with the teacher. Interviews with the teacher about her assessment practices were on a bi-weekly basis and consisted of observing a videotape of classroom incidents and discussing their impact on instruction. Triangulation of data, member checks, and the teacher's journal were utilized in an attempt to tell a more complete story. Initial data analysis was from the data collection notes, reflection entries, and taped interviews. The study describes incidences of assessment that had immediate, short, and long term impact on instruction. Of the assessments that had an affect on instruction, most had immediate impact, some had short term impact, but few had long term impact.

Brunner, D. Allan

Strand A **Monday, April 1, 1996**
4:00 pm — 5:30 pm
Wabash Cannonball

Teacher Goals and Student Perceptions: A Qualitative Look at a Quantitative Problem

The primary focus of this observational study was to examine the correlation between the content goals and objectives of a chemistry teacher and the content goals and objectives perceived by the students. A secondary focus was to examine the differences in specific content background concepts necessary for student success, as perceived by the teacher and the students. Two classes, comprising a total of 20 chemistry students, were selected for observation during the complete pre-lab, lab, and post-lab cycle. Student and teacher perceptions of conceptual knowledge needed to complete the laboratory activity were assessed using a researcher- designed questionnaire. Results indicated that a minority of students involved in the laboratory experiment had goals and objectives that aligned with those of the teacher. It was concluded that what the teacher thought he was communicating to his students with regards to conceptual content was not perceived by his students. Previous studies have attempted to quantify concept acquisition through content-specific tests and quizzes. This study differed in that it attempted to examine an intact dynamic class without using the laboratory as an experimental treatment.

BEST COPY AVAILABLE

Bryan, Lynn A.

Strand D **Monday, April 1, 1996**
10:30 am — 12:00 pm
Illinois Central

Preservice Elementary Teachers' Thinking about Science Teaching: Experiences, Frames, and Inconsistencies

Sandra K. Abell **Maria A. Anderson**

In this study, we investigated the nature of preservice elementary science teachers' reflections in the context of an integrated media reflection program implemented in our science methods course. Based on our students' responses to the reflection tasks and interviews, we are beginning to see the relationship between preservice elementary teachers' experiences and their framing of problems of practice. The principle idea we advance in our paper is that preservice teachers often exhibit inconsistencies in their thinking about science teaching when they frame problems of practice from a perspective for which they have a paucity of experience. After a presentation of the experiences that preservice teachers identify as influential in their thinking, we share our findings about the types of frames they employ when reflecting about science teaching. Finally, we discuss several cases that illustrate the interplay between the preservice teachers' repertoires of experiences and their use of multiple frames in their inconsistent thinking about science teaching.

Buczynski, Patricia L.

Strand E **Sunday, March 31, 1996**
8:30 pm — 10:00 pm
Regency A, B, C

Using Structural Equation Modeling Analysis to Confirm the Underlying Dimensions of the New Michigan High School Proficiency Examination

Burton E. Voss

Confirmatory factor analyses on the hypothesized dimensions of the Michigan High School Proficiency Science Test were conducted on a sample of 934 eleventh graders. A total of five confirmatory models were tested as was an overall structural model of scientific literacy. Both statistical and practical fit indices were calculated for each model. Overall results were encouraging as results indicated that, generally, the hypothesized dimensions held. Chi-square fit statistics and the respective p values are reported, as are root mean square residuals, goodness of fit indices, adjusted goodness of fit indices, rho, and delta.

Burke, Christopher

Strand F **Monday, April 1, 1996**
10:30 am — 12:00 pm
Grand A

Questions and Issues Raised by Teaching Science Using a Thematic Approach in Elementary Teacher Education Courses

B. C. Bruce **M.D. Osborne** **Trudy Morritz** **Anna Li**

In this interactive session, presenters will stimulate discussion by sharing syllabi and experiences of thematic science teaching in elementary teacher education. Discussion will be organized around the questions: How can we effectively prepare elementary school teachers to teach science in a thematic and integrated manner? What are the effects on their views of science when we attempt this? Participants will choose to join one of three discussion groups in which different thematic units are discussed. The purpose of this symposium is to explore the implications of teaching science through a thematic approach. We believe that by using such an approach, we can provide an atmosphere which is conducive to valuing the experiences of all of our students and the diverse backgrounds from which they come. This process has implications for how we view traditional science instruction. Traditional western science has excluded the views and perspectives of minorities, women, and working class people. If we are to teach in a manner that values all students' views and experiences, then we need to question the shape of traditional science. Thematic instruction provides a space where the nature of science and teaching can be questioned and our roles can be examined.

Burry-Stock, Judith A.

Strand C **Sunday, March 31, 1996**
7:00 pm — 8:30 pm
Missouri Pacific

Expert Science Teaching: Expert Science Teaching Educational Evaluation Model (ESTEEM) Implementation

The Expert Science Teaching Educational Evaluation Model (ESTEEM) was developed to evaluate expert science teaching according to a combination of a constructivist and expert teaching philosophy. This perspective provides a sound theoretical basis for teaching and learning behaviors focusing on student-centered teaching that promotes meaningful, conceptual learning. ESTEEM is a professional development model to be administered by oneself, a peer, or an external evaluator. It houses five instruments designed to assess expert science teaching for both teaching practices and student outcomes and is currently being used for evaluating expert science teaching in many national projects.

Caggiano, Mary E.

Strand G **Tuesday, April 2, 1996**
10:30 am — 12:00 pm
Frisco

Science Teacher Socialization through Telecommunication

Richard Audet **Gerald Abegg**

The focus of this study is to understand the development of a community of science teachers coming together through a telecommunications network. Teachers, from across the United States, introduced themselves electronically before meeting for a 'face-to-face' institute. Following the two week institute teachers returned to their homes and continued to interact electronically. With opportunities to interact with colleagues through e-mail, bulletin boards and conferences, professional development by documenting patterns of teacher discourse, participation and changes (frequency and type of use) in utilizing the various electronic opportunities. With a staff of 3 scientists, 4 expert teachers, an evaluator and online moderators, preliminary findings indicate that over the course of a year, 32 teachers used a telecommunication network to interact with one another by sharing resources for classroom maintenance, inquiring about new classroom strategies, and offering others opportunities for sharing teacher resources, the community has become a new means for understanding the process of teacher socialization. Furthermore, the development of this network into a community of teachers, with 60 new teachers this year, indicates the potential of telecommunication networks for developing a collaborative community of professional practitioners.

Cajas, Fernando

Strand H **Tuesday, April 2, 1996**
10:30 am — 12:00 pm
Wabash Cannonball

The Expert-Novice Paradigm: An Epistemological Evaluation

The structure of the expert knowledge (which includes propositional and procedural knowledge) in scientific and educational communities is analyzed. The implicit philosophical, propositional and procedural knowledge is also studied. A minimal theoretical model for science teaching is introduced. Using this model it is concluded that the expert teacher knowledge is characterized by other components which do not appear in the scientist expert knowledge, particularly for the emergence of the pedagogical content knowledge: propositional and procedural. It is discussed that the notion of expert knowledge is contextual, consequently it is important to know the context in which the expert is embedded. A discussion on the epistemic relation between expert and novice inside scientific and science education communities is presented. The clarification of the epistemic relation between both communities is fundamental for understanding the expert-novice paradigm.

Calvert, Renna B.

Strand D **Monday, April 1, 1996**
1:00 pm — 2:30 pm
Illinois Central

An Investigation of the Use of an Innovative Instructional Organizer for Teaching Science: "How Can You Know?"

This study was designed (1) to study the implementation of a "How Can You Know?" (HCYK) instructional approach in school science which resulted from a teacher enhancement workshop and (2) to study how emphasizing this type of organizing strategy may expand students' understanding of science and influence attitudes in an increasingly scientific and technological society. A particularly valuable attribute of the HCYK organizer is its impact upon science as a way of thinking. This study is a presentation of a case study of the observations and accompanying interviews, conversations and other data collections pertaining to the use of a HCYK teaching strategy by teachers. Other data sources included participant observation, teacher and student interviews, teacher and student questionnaires, documents of classroom activities, and quantitative description derived from surveys and questionnaires. The conclusions of this study point to an innovative instructional organizing strategy which when implemented as a frequently used instructional method improves students' understanding of science as well as their attitudes toward science. When teachers were observed using the HCYK method, there was an increase in time spent in classroom activities that seemed to translate into better understanding by the students.

Carnes, Nathan

Strand C **Monday, April 1, 1996**
8:30 am — 10:00 am
Missouri Pacific

Blending the Panorama with the Close Up View: Practical Procedures and Examples

Arta Damnjanovic

This paper is part of a comprehensive study that examines the impact of a statewide systemic initiative in Ohio. In this paper, the authors relate changes that are taking place in a select group of schools to the systemic reform efforts in the state. The quantitative and qualitative data discussed in this study were gathered in the larger project. Principals, mathematics and science teachers, students, and parents in 126 schools responded to questionnaires that focused on classroom instruction, administrative support, parent as well as peer influences, and issues of school change. Qualitative data was gathered during three day site visits conducted in 12 schools. During the site visits, researchers interviewed principals, teachers, and students. They made classroom observations and artifacts were collected. Using the 18 categories (described in Roychoudhury's paper), qualitative data were organized for each site. This paper discussed two urban sites (enrolling primarily African American students) and analyzes achievement data within the educational context. Issues of equity and change within two urban schools provided a focus for a discussion of the matched components.

Carrera, Beatriz

Strand I **Tuesday, April 2, 1996**
8:30 am — 10:00 am
Frisco

Envestigaciones en la Maestria en Educación Ambiental del Instituto Pedagogico de Caracas, a Traves de los Proyectos de Tesis

El presente trabajo tiene como objetivo principal presentar las temáticas y tendencias en los cuales se inscriben los proyectos de investigación para los Trabajos de Grado de los cursantes de la Maestria en Educación Ambiental, que desde el año 1991, se ofrece en el Instituto Pedagógico de Caracas. Mediante un proyecto de tutoria colegiada y la orientación hacia la investigación a través de los diferentes cursos, se facilita el rápido avance de los estudiantes en su proyecto de investigación y se garantiza su egreso a partir del sexto semestre de estudios. Se ha trabajado en el desarrollo y consolidación de cinco lineas de investigación, distribuidas en dos vertientes o áreas: a nivel de escuelas y a nivel de comunidades. Actualmente, siete trabajos de grado han sido defendidos públicamente y dieciseís han sido aprobados por la Comisión Evaluadora de los Trabajos de Grado del subprograma y se encuentran en proceso de ejecución.

Carter, Glenda

Strand D **Tuesday, April 2, 1996**
8:30 am — 10:00 am
Grand C

Alternative Assessment as a Change Agent for Instructional Practice

Sarah B. Berenson **Draga Vidakovic**

This study documents changes in beliefs and practices of 19 teachers who implemented alternative assessments with their elementary and middle school students. These teachers participated in a year long program of action research and reflective interactions with colleagues to evaluate the conceptual understanding of their students. Data collected to document changes included concept maps on assessment, metaphors on teaching, classroom observations, sample student work, assessment portfolios, belief and practice surveys, individual formal interviews and monthly group interviews. A continuum of change for the cohort was mapped using data and investigator triangulation. Change clusters were designated in reference to the reform movement preferred practices. Findings indicated that teachers within clusters shared common characteristics. For teachers with less than four years teaching experience minimal change was observed although need for additional change was recognized. For experienced teachers factors which catalyzed change included positive beliefs about the nature of the learner and an unstable professional environment. Inhibitory factors included negative beliefs about the nature of the learner and status as a teacher leader within the school community.

Caswell, Ruth

Strand D **Monday, April 1, 1996**
2:45 pm — 3:45 pm
Burlington Route

Portfolios Reflect Teacher Knowledge and Instruction

Kathleen Filkins **Karla Nelsen** **Carlton Wendel**

This study examined the changes occurring in teachers' portfolios and how these portfolios reflected classroom instruction. The 30 teachers who maintained the portfolios over 6 science courses taught kindergarten through eighth-grade. Portfolio items for each course were selected by each teacher who indicated why the item was chosen with captions. Teachers also wrote reflections on how the selected items represented their learning. Portfolios were evaluated through reflections of the teachers, examination of the contents by science educators, and interviews with teachers' principals. The results indicated portfolio changes in classroom application and item complexity. The portfolio items were used in classroom instruction, meaningful, and activity- oriented. Complexity was evident in conceptually-oriented units, interdisciplinary units, and activities reaching out beyond the classroom. The resulting portfolios also reflected the teacher's classroom instruction. The portfolios reflect the conceptual understandings gained by these teachers throughout their courses, and the application of this knowledge in their classroom teaching.

Cavallo, Ann M.L.

Strand B **Monday, April 1, 1996**
8:30 am — 10:00 am
Grand B

Testing and Building Causal Models for Meaningful Understanding in The Learning of Genetics Concepts

Raymond B. Miller **Marcy A. Blackburn**

The purpose of this study was to test a model of meaningful understanding in the learning of genetics concepts. Motivation and meaningful learning variables were combined to formulate a model which predicted that reasoning ability, meaningful learning orientation, perceived ability, learning goals, and effort would have positive influences on meaningful understanding while rote learning orientation and performance goals would have no influences, or negative influences. The 114 high school participants received laboratory-based learning cycle instruction on meiosis, central genetics concepts, and use of Punnett square diagrams. Prior to instruction students were administered measures of meaningful learning orientation, reasoning ability, goal orientation, perceived ability, and prior knowledge. Meaningful understanding was assessed following instruction. Results indicated the classroom environment and teacher's instructional style could be enhancing students' perceived ability and effort and enabling students to learn meaningfully regardless of actual goal or meaningful learning orientations. Statistical analyses revealed reasoning ability, perceived ability, and effort to be significant predictors of meaningful understanding. Meaningful learning and goal orientations were not significant predictors. Although the causal model did not hold up under path analysis, the finding that a particular learning environment may lead to increased meaningful understanding could have significant implications for science education.

Change, Wen-Hua

Strand D **Monday, April 1, 1996**
8:30 am — 10:00 am
Grand C

Introducing Philosophy of Science Through an Activity for In-Service Teachers to Experience Social Constructing of Knowledge

The purpose of this study was to develop and try out an activity in a group of ten in-service teachers enrolled in a training program. Owing to the little understanding about the epistemological status of scientific knowledge the teachers shown in group discussions, the researcher, being the science methods instructor, designed an activity based on a learning cycle teaching approach. In the activity, the teachers experienced the social constructing of knowledge and were promoted to an understanding about the philosophy of science. The influence of learners' pre-conceptions in science teaching and learning was also explored. The in-service teachers showed a positive attitude toward this instructional strategy. They agreed that the importance of the learners' preconceptions in learning science, however, they argued that time limitation and how the textbook edited were barriers to adopt constructivist teaching approaches. The teachers with better understanding about the epistemological status of the scientific knowledge, are more willing to incorporate history of science and group discussion into their teaching.

Chiappetta, Eugene L.

Strand E **Tuesday, April 2, 1996**
8:30 am — 10:00 am
Missouri Pacific

Exploring Essential Topics to Teach High School Biology Students

David A. Fillman

The intent of this study was to identify a core list of specific biology topics, which could form the basis of a high school biology course, engaging students in the in-depth learning of fundamental ideas related to their lives. Many high school biology courses contain too much course content, resulting in students memorizing many terms and covering subject matter in a superficial manner. In order to identify a core list of essential topics, seven science supervisors were asked for their opinions using a three-round Delphi survey. These individuals have all taught high school biology and have served for many years to direct curriculum development at the state and district levels. The results indicate that most of the supervisors appear to believe that we should teach students the big picture, which seems to include six unifying principles of biology. Perhaps the "big picture" recommendation will continue to reinforce the coverage of many biology topics, lessening the possibility for students to construct meaningful knowledge.

Chin, Chi-Chin

Strand J **Sunday, March 31, 1996**
7:00 pm — 8:30 pm
Burlington Route

Elementary Students' Alternative Frameworks About the Dinosaurs

In a child's mind, dinosaurs are creatures with a mystical charm. Every major natural history museum in the world has rich dinosaur collections and fascinating dinosaur galleries are very popular among children. This study held by curators in the National Museum of Natural Science(NMNS) was mainly to investigate the alternative framework of Taiwanese children about the dinosaurs. An inventory with 13 multiple-choice questions including topics such as the existence of dinosaurs, their size, intelligence, skin colors, reasons for extinction, and the relationship between dinosaurs and man was developed. Totally 651 children belonging to three age groups(grade 2,4 and 6) were randomly sampled from 5 elementary schools in Taichung Area for giving the answers to the inventory. Some children were also selected for in-depth interview. The results showed that there was significant difference in the preference to the dinosaurs between boys and girls. In this study, children's perceptions and attitudes toward the dinosaurs were reported. Some alternative concepts held by children were also discussed. The findings are beneficial for NMNS to understand what young visitors thought and obtain an empirical evidence for refining the Dinosaur Gallery.

Chiu, Mei-Hung

Strand A **Tuesday, April 2, 1996**
4:00 pm — 5:00 pm
Burlington Route

The Effectiveness of Self-Explanations in Learning High School Chemistry

The purpose of this study was to examine the effectiveness of the use of self-explanations (SE) to learn chemical equilibrium concepts by high schools students. Students' performance was measured by a criterion-referenced test categorized into four categories. The four categories were descriptions of terminology, daily life situation items, content-related multiple choices, and problem solving questions. Results indicated that there was no significant differences on overall performance between two groups (SE group and no SE group). However, when the students were grouped by their performance on the test, the analyses revealed that for the overall performance for all three abilities groups had reached the .05 significance level, that is, the SE group outperformed the No SE group for both successful and intermediate groups, whereas the No SE group performed better than the SE group for the less successful students. This result suggested that the learning strategy of self-explanations might be more useful for the more able students, whereas this might hinder the lower ability students' learning.

Chyuan, Jong-Pyng

Strand A **Monday, April 1, 1996**
4:00 pm — 5:30 pm
Grand D

Determining the Teaching Concepts About "The Earth as a Complex Environmental System" in Elementary Schools in Taiwan

The purpose of this study was to investigate what concepts elementary students understand about The Earth is a Complex Environmental System which is the first outline in The Framework of Environmental Concepts for the Republic of China. A conceptual teaching structure was constructed for elementary students in Taiwan. Thirty-seven environmental propositions covering eight main environmental concepts were developed for use in teaching elementary students. The propositions were administered to 9200 students in 39 elementary schools. Through statistical analysis, a concept structure about teaching The Earth is a Complex Environmental System from grade 1 to 6 was determined. The fundamental concepts suggested through data analysis to be taught in schools are: Air and water in grade 1; Air pollution in grade 2; Carbon dioxide and forest ecosystems in grade 3; greenhouse effect and deforestation in grade 4; renewable resources and non-renewable resources in grade 5; and photosynthesis and ecosystem management in grade 6.

Ckhekuri, Nageswar Rao

Strand C **Monday, April 1, 1996**
4:00 pm — 5:30 pm
Burlington Route

A Physics Problem Solving Model for Developing Interpretation Skills

Glenn C. Markle

Students enrolled in introductory physics at a technical college were taught to solve problems using a modified version of Greeno's problem solving model. The modification placed greater emphasis on developing interpretation skills and on the ability to use the mathematical representation of the problem as a basis for formulating hypotheses about theoretical relationships among the variables in the problem. The study addressed four questions: 1) Can students be taught to use the problem solving model to solve text book problems? 2) Do students develop better interpretation and hypothesis formation skills when they use the problem solving model? 3) Do students develop a better understanding of related physics concepts and principles when they use the problem solving model? 4) What are the nature and causes of students' difficulties as they attempt to follow the model when solving physics problems similar to those that are found in most textbooks? Eight students were the subjects of this study. Their responses to test items and interview questions, and analyses of videotapes of them solving problems, provided the data to address the research questions. Results suggest that students' can be taught to use the problem solving model and that their interpretation skills, ability to formulate theoretical relationships among variables, and understanding of physical principles are likely to improve when they use it. In addition to describing the study, the details of the problem solving model and implications for college-level physics instruction will presented in the paper and discussed during the session.

Cobern, William W.

Strand B **Sunday, March 31, 1996**
7:00 pm — 8:30 pm
Grand B

The Different Worlds of Biology and Physical Science Teachers

Adrienne T. Gibson Scott A. Underwood

A science teacher not only presents scientific concepts, but tacitly creates a context in which scientific concepts are presented to the class. This context can be strongly influenced by teacher beliefs or worldview. In the current research, teacher worldviews with respect to the essence of nature were examined. Two biology and two physical science teachers individually sat for qualitative interviews. The same interview protocols were used in concurrent study involving ninth graders at their high school. The analysis led to two assertions: (1) When compared with their students, the science teachers had a much more focused and less diverse understanding of the natural world. The students were much more likely to speak of aesthetic and spiritual elements of nature in contrast to their teachers who focused more on what one could know about nature. (2) The most interesting finding was that the physical science and biology teachers had considerably different conceptualizations of nature. The physical science teachers talked much more about all that scientists do know about nature and how successful science has been. The biology teachers were much less sanguine about science, yet clearly enthusiastic. They showed greater concern about the environment and were more likely to speak of the aesthetics of nature.

Collins, Angelo

Strand C **Sunday, March 31, 1996**
7:00 pm — 8:30 pm
Wabash Cannonball

Action Research and Learning Theories: Reflective Tools for Professional Development

Samuel A. Spiegel

As part of a teacher enhancement project, sixty-five middle school science teachers went through the process of planning, implementing and reporting research from their classrooms. Additionally, during the planning phase of their research, each teacher was required to write their learning theory and compare it to their practice. This study documents the process the classroom teachers experienced when learning to conduct and report action research and examines the articulation of the teachers' interpretative framework through developing their learning theories. Several notable trends in the teachers responses to the action research are reported. Throughout the research and articulation phase, growth in the teachers was apparent in obvious stages. Two themes dominated the learning theories of these teachers: statements about the importance of prior knowledge, prior experience or the relationship between prior knowledge and experience to current learning; and the importance of student interest, relevance and motivation. These themes were further reflected in the teachers' research questions. Implications of the interplay between the two activities are discussed in relation to both the contribution toward a knowledge base for teaching and the professional development of teachers.

Collins, Angelo

Strand H **01/04/96**
10:30 AM — 12:00 PM
Regency C

Scientfic Literacy: Myth or Possibility

Ronald G. Good William C. Kyle, Jr.

What is scientific literacy? How should we assess whether students have acquired the knowledge and skills associated with citizenship and social responsibility? Should science educators be responsible for transcending school science literacy to adult science literacy? Has conventional science education failed to achieve its goal of a scientifically literate public? Scientific literacy: is it a myth or in the realm of possibility? Morris Shamos' recent book, The Myth of Scientific Literacy, has brought to the forefront issues that we believe science educators ought to reflect upon. Can we establish meaningful goals for scientific literacy or are our current reform efforts doomed from the outset because the goals are unattainable? We envision lively discussion and debate among these and related questions. We look forward to your active contribution.

BEST COPY AVAILABLE

Cooper, C. Kay

Strand D **Wednesday, April 3, 1996**
10:30 am — 12:00 pm
Illinois Central

Qualitative Analysis of Preservice Elementary Teachers' Scientific Ways of Thinking, Attitudes and Perceptions During Collaborative Earth Science Field-Based Experiences

Emmett L. Wright

The purpose of this study was to analyze the manner that the preservice elementary teachers, who participated in a newly designed science, mathematics and technology preparation program: 1) used scientific ways of thinking to construct new knowledge during a set of Earth science field-based activities; 2) modified their attitudes about the importance of Earth science field-based methods; and, 3) perceived their future roles as teachers using field-based methodology with elementary school students. A multifaceted method of data collection was utilized during the Earth science field-based experiences. The methods included: videotape recordings, participant-observer anecdotal records, activity specific journals, student field-based assignment reports, a post-course attitude assessment, and post-course interviews. Major findings concluded that: 1) working in collaborative groups of three individuals increased the participants' sense of security and promoted problem-solving during activities, 2) positive attitudes toward this method of learning and good work attitudes during field-based activities were developed, 3) the preservice elementary teachers could visualize their roles as teachers of elementary school students using Earth science field-based experiences as a teaching method, and 4) scientific ways of thinking by students evolved during the semester, including observing, classifying, measuring, communicating, inferring, predicting, questioning, hypothesizing, processing and interpreting data, and formulating explanatory models.

Cooper, David

Strand E **Monday, April 1, 1996**
10:30 am — 12:00 pm
Regency B

Does Participation in a District Wide Science Framework Make a Difference?

Brenda Waldon **David Butts**

The User-friendly Science Project of the Clayton County schools was designed to generate a science conceptual framework which then was used to accomplish three goals: provide a basis for development curriculum topics for each grade level, K-8; enhance articulation of science topics across grade levels in ways that would help student generate a solid basis for their personal science literacy and to serve as the baseline for decisions about curriculum resources, such as text books, which are to be adopted in the future. As part of this project, five grade level staff development courses were conducted during the summer of 1994 involving about 100 teachers. Of this number, 35 were selected to field test the curriculum topics that had been developed for the project. Utilizing the PACE model, teachers described of what they expected, what they valued and what they actually did in their classroom as a result of the courses. Most teachers expected this to be an opportunity to strengthen their science background, change their personal attitude toward the physical sciences and experience a variety of ways to improve hands-on learning for their students. They valued most the close congruency between the course activities and what they were going to be doing with their students in their classroom. Since they all met the expectation of using the topics in their classroom, these staff development courses were clearly an outstanding success. In the actual field test of topics, teachers tended to teach the topics stressed in the course. Thus, if teachers are expected to use topics in their classroom, then care should be given to see that the course content reflects this intent.

Coppola, Brian P.

Strand G **Tuesday, April 2, 1996**
10:30 am — 12:00 pm
Grand A

Integrating Computational Chemistry into a Structured Study Group Program for University Honors Students

Douglas S. Daniels Scott T. Lefurgy

At the University of Michigan, students with a good high school chemistry background begin their University study with Structure and Reactivity, a two-term sequence based on contemporary mechanistic organic chemistry with an overarching liberal arts perspective of intellectual inquiry. A cohort of 120 Honors students participate within the 1200-student course for their standard coursework and examinations, earning their Honors credit by participating in weekly 2-hour sessions that are shaped, metaphorically, along the lines of a "performance studio" in the Arts. Students bring their work on authentic projects to the sessions and engage in structured peer group critiques facilitated by upper-level undergraduate leaders. Most of the projects broaden and deepen the students' learning of associated course topics, and usually involve mastering tools used by practicing chemists, especially library resources and software. In 1995-96, tasks involving a state-of-the-art computational chemistry package, CAChe (Computer-Aided Chemistry), were integrated into the Honors projects. The CAChe program uses a spreadsheet-based shell that allows students to construct correlative models for observed phenomena where they can incorporate everything from quantum mechanically sound three-dimensional representations of geometries and orbitals to numerical approximations for physical and chemical properties.

Coppola, Brian P.

Strand H **Tuesday, April 2, 1996**
8:30 am — 10:00 am
Jeffersonian

Mea Culpa: Formal Education and the DIS-Integrated World

Douglas S. Daniels

Formal education has removed itself so far from any truly integrated view of the Natural World that fragmentation and certainty are prevailing ethics. Technological progress has resulted in increased specialization within academic disciplines and their concurrent separation from each other. Knowledge is extracted from a fully integrated world, but is examined and defined by the "dis-integrated" world of the compartmentalized university. In practice, a science education is still defined by most curricula as the mastery of some corpus of facts. In the conflict over content, value-based and integrative (critical) reasoning issues were among the first casualties. We have addressed the relationship between re-integrated, value-centered instructional goals and actual classroom practice in introductory science. We will provide ideas and strategies that describe our effort to re-integrate the educational experience of beginning college students, including (1) the role of representational systems, and the use of inference and implication; (2) the use of historical and philosophical aspects of science knowledge; (3) the development of new metaphors to make metacognitive skills more accessible; (4) the development of a "performance studio" aspect to science classes; and (5) the articulation of common language and ideals for instructional goals across the university.

Coulter, Robert

Strand G **Tuesday, April 2, 1996**
4:00 pm — 5:00 pm
Frisco

EnergyNet: Learning From Year One

Alan Feldman

The purpose of this study was to perform exploratory research into the experiences of teachers participating in the first year of EnergyNet, a telecommunications based interdisciplinary science curriculum designed for secondary school students. The goal was to identify factors which impeded full implementation of the curriculum and to develop recommendations for year two of the program in 1995-96. In year one, 392 students and 19 teachers from 17 schools across the state of Illinois participated in EnergyNet. Research was conducted through structured interviews with each adult participant (teachers, project coordinator, technical support staff, etc.) and the development of a statistical profile of the ways in which sites participated. Findings of the research project include a list of specific factors affecting full participation in the project. These factors included those generic to the teaching profession, program-specific factors, and factors related to the technology used. The report concluded with a set of recommendations for the implementation of EnergyNet in year two. Preliminary results of year two will be reported in the presentation.

Craven, III, John

Strand E **Tuesday, April 2, 1996**
8:30 am — 10:00 am
Regency B

Defining Public Issues and Concerns Regarding Science Education Reform in Iowa: An Internet Research Project

Chris Lawrence

Current events within learning communities throughout Iowa will radically alter the way we perceive community involvement within the schools of this state. These events are positioning many schools around the state to develop new and innovative collaborations between themselves and local citizens. But what is needed in these partnership is higher-level interactions wherein the community becomes more fully informed about educational issues and changes in current science education reform efforts and where there is an exchange of perspectives, beliefs, ideas, and goals. Before this can occur, however, an understanding of one another's viewpoints and perspectives must occur. This study is designed to assess the understandings, perspectives, and concerns held by the members of the community at large utilizing electronic bulletin boards on the Internet within the state. This is a preliminary study and the responses will aid us in choosing directions for further input from the community. The results of this study can also aid in refining questions which would be used in gaining further input and could be used as initial frameworks, that could be locally adapted, to foster meaningful involvement of the community in education.

Crawford, Barbara A.

Strand B **Tuesday, April 2, 1996**
10:30 am — 12:00 pm
Regency B

Creating a Collaborative Environment in a Middle Grade Science Classroom: Design and Enactment of an Authentic Project

This study explores the building of a community of learners environment through the design and enactment of an authentic project. The intent of creating a community of learners environment is to provide opportunity for students to engage as co-collaborators with the teacher in investigating an authentic problem. This research focuses on the processes which lead to collaborative learning, by examining the interactions of myself, as the teacher, my middle school students, and other people external to the classroom. A framework developed from the literature for defining a community of learners was used to analyze the videotapes of the classroom and a focus group of students. The framework included dimensions of these components: authentic tasks, interdependency in small group work, negotiation of understanding, public sharing, collaboration with experts, and responsibility for shared learning and teaching. Findings suggest that changing roles of students and teacher is difficult, but given time, positive outcomes result.

Crawley, Frank E.

Strand D **Monday, April 1, 1996**
2:45 pm — 3:45 pm
Missouri Pacific

Collaborative Action Research, Reform, and the Need for Triple Consciousness

This study reports on the dilemmas that arise as researcher-teacher collaborators struggle to develop and sustain a triple consciousness while engaged in collaborative action research (CAR). In particular, the project examines the tensions that exist as participants grapple with reforming classroom practice and with the multiple dialectics inherent in CAR: (1) between COLLABORATION as participant or as observer, (2) between ACTION for improved understanding or for improved practice, and (3) between RESEARCH that reifies existing practice or transforms it. These dialectics will be examined in the context of ten CAR projects conducted with science teachers in formal and informal school settings in eastern North Carolina. From the findings emerge guidelines for science educators who are interested in improving research and practice by conducting collaborative action research.

Crockett, Denise

Strand H

Monday, April 1, 1996
4:00 pm — 5:30 pm
New York Central

The Influence of Values on Technology, Education, and Culture in a U. S. Mennonite Community

The Amish Mennonites are selective in deciding which technological advances developed and used in the wider society are made available to their community. These choices allow the community to remain intact and viable by filtering the effects of the secular world on their lives. Their ideal is to select technology congruent with their religious values and beliefs while maintaining a link with the secular economy. This link provides a stable livelihood for the community members. This study is part of an ongoing ethnography of an Amish Mennonite community in the southeastern U.S.A. It began with examining how science and technology are treated in school curriculum and instruction, and rapidly evolved in response to the realization of the importance of community appointed apprenticeships. Education permeates Mennonite lives and occurs everywhere in the community. Amish Mennonite education teaches values to the children so they can function as adults spiritually, communally, and economically.

Crowther, David T.

Strand D

Tuesday, April 2, 1996
4:00 pm — 5:00 pm
Grand C

Attitudes and Experiences of Preservice Elementary/Middle Level Teachers as They Engage in Alternative Content Science Courses

Ron J. Bonnstetter

In response to national reform movements content science courses specifically for elementary and middle level education majors have been developed in a collaborative manner between the department of life sciences and Teachers college. Preliminary quantitative results showed significance in attitude and confidence in learning and teaching science from these majors. This study is an in-depth qualitative case study using cross case analysis in order to explore the reasons of the attitude and confidence shift by analyzing interviews, journal entries, video tape, and other anecdotal data. This session will discuss the innovative science courses with related collaboration and design along with the qualitative results and conclusions derived from the participants of the study.

Cummins, Catherine L.

Strand A

Tuesday, April 2, 1996
8:30 am — 10:00 am
Jeffersonian

Teaching About the Nature of Science through Science Fairs: Judges' Perspectives on Student Learning

The production of science fairs at their many levels provides fine examples of diverse collaborations of a wide variety of students and scientific professionals. This study reports on the analysis of a questionnaire that asked science fair judges about their understandings of the nature of science (experimental vs. descriptive and comparative methods) and how this related to their evaluation of projects. The results show that judges do not agree with the distribution of point values given to judging categories supplied by the International Science and Engineering Fair (ISEF). By far the most important category to these judges is scientific thought, which deals directly with the judges' understanding of the nature of science. Judges were also given a definition of research as "the process of doing an experiment" and asked for comments. The comments can be grouped into three categories, (1) those who agreed (24.74 %), (2) those who agreed but said that the definition was incomplete (46.39 %), and (3) those who disagreed and specifically commented on nonexperimental methods (28.87 %). In almost every case, a respondent who mentioned nonexperimental methods specifically identified themselves as a research scientist/professor. This is especially notable when one reviews the qualifications for judges for the ISEF.

Cunningham, Christine M.

Strand F **Tuesday, April 2, 1996**
4:00 pm — 5:00 pm
Missouri Pacific

College Freshwomen's Experiences of a Research Internship: An Analysis of Reflective Journals from Participants of the Women in Science Project (WISP)

Valery S. Hussain **Mary L. Pavone** **Carol Muller**

This paper reports a result of an evaluation of the Women in Science Project (WISP) at Dartmouth College. Through paid research internships for freshwomen, and various other activities, WISP aims to increase the number of first-year women students enrolling in, majoring in, or pursuing a career in science and engineering fields. This paper provides a brief description of the internship program before describing insights from the analysis of biweekly journal responses written by the 1995 participants during their six month research internships. The journals give an ongoing snapshot of obstacles faced, feelings of frustrations, and knowledge gained of both the content and the practice of science that students reported was not available from their introductory science courses. The findings from our research could help improve retention programs for women by providing information that can be used to tailor Dartmouth's program to the needs of the students it serves; and by providing valuable insights of students' needs to a larger educational audience. The identification of students' needs, of factors that contribute to female dropout from science, and of the successful features of WISP should inform program design and implementation at other institutions.

Cunningham, Christine M.

Strand H **Tuesday, April 2, 1996**
8:30 am — 10:00 am
New York Central

Sociology of Science: Theoretical Constructs, Applications, and Implications for Science Education

Jenifer Helms **Gregory J. Kelly** **Wolff-Michael Roth** **William S. Carlsen**

This interactive symposium will explore the use of sociology of science perspectives in science education research, and will sponsor a conversation about avenues for further inquiry. Within the general framework of sociology of science, analyses such as laboratory studies, feminist critiques of science, and explorations of the interplay between science and society may help science education researchers to understand better the practice of teaching science and to help create a more authentic school science. Drawing from the conceptual tools of sociology of science, topics discussed will include the visibility of social networks, the use of inscription devices, and the connection of science to political, economic, cultural, and gendered contexts. These topics will be treated with respect to issues of educational reform in science such as teacher knowledge, community-based science projects, and designing and studying improved learning contexts. Although each of the five participants will bring specific sociological issues into the conversation, the principal activity will be a discussion among the participants and audience. In order to facilitate audience participation, textual materials will be distributed before the session to anyone requesting them from the symposium organizer (send an e-mail request to CMC3@CORNELL.EDU).

Czerniak, Charlene M.

Strand C **Tuesday, April 2, 1996**
8:30 am — 10:00 am
Wabash Cannonball

Relationship Between Teacher Beliefs and Science Education Reform: What Are Teachers' Beliefs About Thematic Units?

Andrew T. Lumpe **Trudy Grafton**

Current science education reform documents include thematic instruction as a key idea in school science programs. Teachers' beliefs about curriculum and instruction may play an important role in the implementation of reforms such as thematic instruction. In this study, we sought to examine the influence of K-12 teachers' beliefs on their intent to implement thematic units in their classrooms. The Theory of Planned Behavior was used to examine the influences of K-12 teachers' attitudes, subjective norm (social support), and perceive behavioral control (external influences). Specific suggestions for addressing teachers' beliefs about teaching thematic units and staff development ideas are offered.

Dagher, Zoubeida

Strand H **Monday, April 1, 1996**
8:30 am — 10:00 am
New York Central

A Teacher's Practices and Students' Understanding of Science: The Case of a Seventh Grade Classroom

This paper explores how a 7th grade teacher and his students understand science based on year-long observations and statements from interviews with the participants. The teacher's primary goal for his students was to understand science in a particular way, and his philosophy reflected very well in the way he conducted classroom activities. In the paper, I will focus on excerpts from classroom teaching that dealt with the intersection of scientific beliefs with religious/cultural beliefs and examine how the teacher's philosophy of education and of science, disclosed in informal discussions and end-of-year interviews, was reflected in his interactions with students' ideas. Some of the students' understandings of the nature of science could be extracted from their classroom interactions and some were captured in their answers to the interview question: "If an alien (or someone who does not know what we mean by science) asked you what is science all about, what would you say?" Almost all of the interviewed students responded in ways that were congruent with the teacher's primary goal. This paper demonstrates how the purposive and deliberate attention on the part of the teacher to issues that relate to the nature of science throughout the school year reflects positively on students' understanding of science and understanding of themselves in relation to the world.

Damnjanovic, Arta

Strand D **Tuesday, April 2, 1996**
2:30 pm — 3:30 pm
Grand C

Preservice Teachers' Perceptions of Inquiry: Current Views and Future Uses

Jane Butler Kahle **Jim Poth**

The purpose of this study was to determine how preservice teachers define inquiry instruction and to summarize how well they believed inquiry would work in their future classrooms. Semester long (15 weeks) field observations were made in a Physics by Inquiry course taught at a midwestern university. Both course instructors and preservice teachers attending the course were interviewed. Preservice teachers in the study had a difficult time defining inquiry. Furthermore, they saw inquiry as a good alternative to traditional methods of instruction, but predicted that it would work poorly in their classrooms. Specifically, preservice teachers saw many barriers to implementing inquiry in their future classrooms. Ways preservice teachers could overcome these barriers to inquiry are discussed.

Davis, Kathleeen S.

Strand F **Monday, April 1, 1996**
4:00 pm — 5:30 pm
Grand A

Science Support Groups and Women Science Educators: Advocates for Women's and Girls' Legitimate Participation in Science

This study examines two "gender-sensitive" science support groups that seek to provide opportunities for women's and girls' legitimate participation in the science community. Through participant observation, interviews, and analysis of documents, this study examines Explorers, a diverse after-school science club for girls, and Women in Science, a group of women working at an academic research institution, and describes the specific kinds of capital that were needed, sought, and used within the groups and the ways in which this capital was acquired. Factors that affected science access and participation included: 1) the provision of materials and a context for inquiry for low-income girls, 2) the inclusion of multiple perspectives and experiences, 3) conflict with traditional societal and cultural beliefs regarding gender, race, and class, 4) conflict with the structure and practices of the science community and government agencies, and 5) the experiences, knowledge, and beliefs of the women science educators who facilitated the groups. The ways in which these groups intersected with the larger science community is examined.

Davis, Nancy T.

Strand C **Monday, April 1, 1996**
4:00 pm — 5:30 pm
Missouri Pacific

Patterns of Learning Revealed Through Autobiography

The objectives of this presentation are to 1) examine the impact of teachers' writing of critical educational autobiographies on their learning process; 2) discuss issues associated with teachers' writing of critical autobiographies; and 3) to propose a model of personal learning based on teachers' writings. The autobiographies trace experiences in science teaching and learning and explore changes that were made in the teachers' thinking and actions. Over seventy critical educational autobiographies written by teachers from elementary, middle, and high schools provide primary data for this research. Document analysis utilized category coding techniques of data reduction. Analysis across the teachers' writings suggests components of a personal change process which include disturbance, alternatives, confidence and action.

Dawson, George O.

Strand G **Sunday, March 31, 1996**
7:00 pm — 8:30 pm
Frisco

Research Opportunities in the Multimedia Enhanced Science Classroom

This paper presentation will provide a review of the research regarding teaching and learning using interactive media and the need and opportunities for additional research. Recent development work of the Interactive Media Science Project will be examined and linked to deficiencies in investigative work. This presentation will also serve to introduce three related research events.

Demastes, Sherry S.

Strand A **Tuesday, April 2, 1996**
8:30 am — 10:00 am
Missouri Pacific

Students' Patterns of Biological Explanations: Trends in Knowledge Frameworks and Spontaneous Explanations

Eleanor Abrams **Catherine Cummins**

The purpose of this study was to (a) document students' abilities to construct causal explanations of biological phenomena, (b) describe any patterns in these explanations, and (c) determine if explanations are a reflection of static conceptual frameworks or students' spontaneous constructions. A total of 108 participants were selected from a variety of grade levels (second, fifth, eighth, and twelfth) from three geographical regions in the United States. Students participated in an interview-about-instances of changes in a variety of organisms. The interview transcripts were reviewed by three researchers to identify any trends. Results indicate that students from all grade levels were capable of constructing explanations regarding the ultimate causes for changes in biological organisms, but were largely unsuccessful in constructing proximal explanations of the same phenomena. Students from the eighth and twelfth grades were more likely to offer teleological explanations of ultimate causality, while younger students were more prone to use anthropomorphic reasoning. However, these trends were complicated by changes in reasoning dependent on the kind of organism involved. Finally, while the majority of students' explanations could be explained using a conceptual framework understanding of knowledge, other explanations could better be understood as spontaneous constructions.

Deng, Zongyi

Strand C **Tuesday, April 2, 1996**
10:30 am — 12:00 pm
Wabash Cannonball

Knowledge About Key Ideas: A Case Study of Two Middle School Science Teachers

The purpose of this study was to examine the nature of science teachers' knowledge about key ideas in the teaching of a particular science topic to students of a particular age. The examination was conducted in the context of a series of lessons on the topic atomic structure taught to 8th grade students by one beginning science teacher and one experienced science teacher. Data collection strategies included classroom observation, video-taping, and document gathering. The findings revealed that a science teacher's knowledge about key ideas was a precondition for the selection or development of effective pedagogical representations and instructional strategies. The study argued that in addition to knowledge of pedagogical representations and instructional strategies, knowledge about key ideas was a critical component of pedagogical content knowledge in science teaching.

Deru, David B.

Strand E **Monday, April 1, 1996**
2:45 pm — 3:45 pm
Regency B

Cultural Synergy and the "Model for Negotiation" in the Development of a Nigerian Science Curriculum

Joseph P. Riley

The purpose of this paper is to present an overview of the interlocking and cooperating cultural elements (Synergisms) to the evolution, construction and utilization of a Model for Negotiation used in the development of a science curriculum in a Nigerian setting. This study was undertaken under the auspices of the United Nations Development Program's (UNDP) Transfer of Knowledge Through Expatriate Nationals (TOKTEN). The study underscores several implicit and explicit nuances involved with consultancy/project development particularly in international contexts where culture plays a significant role, when interacting with stake-holders, policy makers and others critical to the project's success. The study further reports on the merits and perspectives of this model for curriculum development and its other multifaceted applications. It also presents relevant implications and recommends directions for further study.

Deshon, Fred

Strand E **Tuesday, April 2, 1996**
8:30 am — 10:00 am
Wabash Cannonball

Towards An Outcome Based Science Education System: A Description of The Western Australian Process

Tony Fetherston

Outcome Based Education (OBE) is now either in use, or under consideration, in many countries around the world. In Australia, individual states have been trialling outcome statements under the umbrella of national profiles. In Western Australia, as a prelude to a decision being made whether to adopt OBE, outcome statements have been developed using an open and consultative process involving teachers. Statements have been developed in five strands each with eight levels. This paper describes the developmental process which has resulted in statements which reflect conceptual progression and appear to be useable and acceptable to teachers. Also described will be the theoretical underpinnings of the statements and the potential the statements have for pedagogical reform.

Desouza, Shireen J.M.

Strand E **Sunday, March 31, 1996**
8:30 pm — 10:00 pm
Regency A, B, C

Lessons From Weyerhaeuser — Developing a Curriculum Through Collaboration

This poster presents the collaborative efforts of the researcher, elementary and middle grades science teachers, resource personnel, and the engineers of the Weyerhaeuser Co. -Pulp Division, Oglethorpe, Georgia, in preparing an interdisciplinary curriculum that effectively integrates science, mathematics and technology. The central theme of the curriculum is the manufacturing of paper and all related science concepts. The curriculum is community-based and offers a hands-on approach to the teaching of science. The evaluation of this project involved the development and presentation of a portfolio containing a reflective journal, unit plan, resource materials and a critique of the present curriculum used in schools.

Devi, Bharati S. K.

Strand D **Tuesday, April 2, 1996**
10:30 am — 12:00 pm
Grand C

Conceptual Changes in a Preservice Teacher's Beliefs in Constructing a Model for Science Teaching

Mary M. Atwater

The purpose of this study was to investigate a preservice teacher's understanding of multicultural issues, science learning, and science teaching and their interrelationships. The participant was interviewed with open-ended questions during his enrollment in a teacher science education program. Interpretive analysis of the interviews revealed the conceptual categories of his beliefs. Results indicated the preservice teacher's model for teaching was initially based on his own learning experiences with no particular emphasis on multicultural issues. By the end of the science teacher preparation program, the teacher had made conceptual changes to his science teaching model; however, his views on cultural and ethnic issues remained the same.

Dickinson, Valerie L.

Strand D **Wednesday, April 3, 1996**
10:30 am — 12:00 pm
Illinois Central

Oil and Water Don't Mix — What About Science and Language Arts?

This descriptive case study was conducted to determine how preservice elementary teachers' ideas about language arts develop during the course of a semester when science lessons and teaching strategies were integrated into the language arts methods classroom. Two classrooms of 23 preservice teachers received science content and pedagogy instruction within their language arts methods course. Five major components of the course, intended to help students reflect on interdisciplinary uses of language arts for science, were concurrently instituted. Data include field notes of discussions and interactions, course assignments (journal reflections, oral presentations, and written papers), and videotaped explorations of science problems during which preservice teachers discussed the relationship to language arts. Results indicated that both groups of preservice teachers saw the importance of using interdisciplinary methods to teach science and language arts. Students viewed language arts as a tool to explore science, and as a way to make more time for science teaching in their classrooms. Implications for teacher preparation programs are discussed, and suggestions for further study are noted.

Dickman, Carolyn

Strand D **Wednesday, April 3, 1996**
10:30 am — 12:00 pm
Grand C

Concept Mapping By Secondary Science Student Teachers on Science, Technology, and Pedagogy: Connections

Meta Van Sickle

A year long multiple case study was conducted on secondary science student teachers to learn what connections, if any, they made among the concepts of the natures of science, technology, and pedagogy. The data were collected four times across a two semester sequence of courses in the form of concept maps. Initial concept maps were collected before practicum and student teaching began. Analysis of the data occurred with each set of concept maps collected. Constant comparison of the data began at the onset of data collection. The students were generally unable to draw any connection between science and pedagogy at the first data collection, and were unable to complete any concept map with regard to technology. The number of connections increased to 10 between the nature of science and pedagogy, but remained sparse with regard to technology. The data indicate that these programs of study do not emphasize technology in such a manner that students are able to develop a connected concept map.

Doherty, Cindy L.

Strand G **Sunday, March 31, 1996**
7:00 pm — 8:30 pm
Frisco

A Sociocultural Look at a Multimedia Middle School Science Curriculum

Recent calls for the reform of science education include the infusion of instructional technology, and greater frequencies of student-entered, problem-solving instructional approaches. These approaches are viewed as ways to increase higher-order thinking skills, make science more meaningful and to portray a more contemporary and authentic image of scientific endeavor. EcoVentures: Learning in Florida's Environment, is an interactive multimedia approach to learning environmental science which was designed to address some of these issues. The purpose of this study was to determine the sociocultural factors which influenced visions for developing and incorporating a multimedia science curriculum. Using a holistic ethnographic approach two cultures were identified, a culture in which the curriculum was developed and a classroom culture in which the curriculum was implemented. Data sources included interviews, field observations and artifact analysis. Findings indicate that each culture has a unique set of influences and factors which were prevalent at the classroom level were not necessarily viewed in the same regard at the developmental level. Also, visions of a multimedia curriculum held by the teachers and developers differed from that which took place.

Dori, Yehudit J.

Strand B

Tuesday, April 2, 1996
2:30 pm — 3:30 pm
Regency C

Question Posing Capability Using An Environmental Case Study Before and After Studying "The Quality of Air Around Us" Module

Orit Hershkowitz

Linking science to social phenomena and to applied technology in everyday life is assumed to make science more relevant and meaningful to students. A "Science, Technology and Environment in Modern Society" (STEMS) project, is currently being pursued jointly by three universities in Israel. Training teachers to incorporate environmental issues within science teaching and developing appropriate learning materials are important components of our project. One group of science teachers developed the module The Quality of Air Around Us, which is based on a cooperative learning (Jigsaw) method. This module encompasses five independent topics: Sulfur Oxides and Particles; Nitrogen Oxides; Carbon Oxides; Ozone; and Odor - Inconvenience or Pollution? The research method included classifying and evaluating students', teachers' and experts' question posing and case study analysis capabilities. In most of the classifications, students showed an increased in the number of questions asked after reading an environmental case study. They also had a more complex view of their real life problems - the chemical plants in a nearby area and the gases these plants emitted. Bringing students to understand conflicts like those in the case studies may encourage them to critically read a pseudo scientific article and question the quality of the given information.

Dori, Yehudit J.

Strand B

Monday, April 1, 1996
10:30 am — 12:00 pm
Grand B

The Mole Environment Studyware: Principles, Design and Implementation

Maira Hemeiri

The mole is a fundamental concept in chemistry. Many students have difficulties in understanding and applying the mole concept. Students therefore adopt a variety of algorithmic techniques for solving problems provided as predefined templates in books, classes, tests and matriculation examinations. Aiming at improving students' problem solving abilities, we have developed the Mole Environment studyware in which mole-related problems have been classified adopting a multi-dimensional scheme. The studyware includes problems which progress in difficulty and complexity based on three transformation dimensions: a. from symbol (chemical formula) to the macro (substance mass) level and vice versa; b. from symbol to the micro (particles) level and vice versa; and c. from symbol to the process (chemical reaction) level and vice versa. It also integrates two learning tools: real-time feedback to the student responses and real-life problems from the domains of environmental studies and chemical industry. The mole environment studyware was implemented in a rural high-school and was very well received. According to the participants' responses, it contributed toward increased understanding of the mole concept.

Dorough, Donna K.

Strand C

Monday, April 1, 1996
1:00 pm — 2:30 pm
Grand B

A Science Teacher's Self-Selected Metaphors: How Do Students' Metaphorical Perceptions Match Up?

Thomas M. Dana

This study explored the metaphors used by a science teacher and her students to conceptualize the role of the teacher in the science classroom, and examined congruences and differences in metaphorical perceptions held by the teacher and her students. The participant, a biology teacher in a Southern liberal arts magnet, was interviewed about her teaching. Subsequently, a questionnaire, presenting a list of ten metaphors which were either utilized by the teacher or taken from science teacher literature, was administered to her ninth grade students. Students were asked to select the metaphor they felt best described their teacher's predominant role in the classroom, and provide reasoning for their selection. Of the 96 questionnaires analyzed, 69% of students chose metaphorical descriptors other than those the teacher had used to describe herself. The most popular response (44%), captain of the ship, manifested many common analogies made in the descriptions of how students transferred this metaphor onto their teacher. However, students' reasoning for selecting this metaphor varied. The results of this study raise definite questions about the nature of students' conceptions of teaching science and how those conceptions might play in achieving science teacher change toward a teaching approach consistent with constructivism.

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Doster, Elizabeth C.

Strand H

Monday, April 1, 1996
4:00 pm — 5:30 pm
New York Central

The Influence of Student Values on Perception of the Dissection Experience

David F. Jackson

This study investigates the socio-cultural values of ten preservice teachers concerning the issues surrounding the dissection experience. Acknowledging the intensely emotional nature of the topic and their own subjectivity, the researchers employed a heuristic inquiry approach. All participants were interviewed using an open-ended semi-structured interview format. Questions focused on their dissection experiences in an undergraduate biology course as well as their personal histories of both formal and informal experiences with dissection. The results are organized around assertions generated through qualitative analysis of the extensive interview data. Participants' perceptions tend toward the extremes of an affective continuum addressing the entangled moral, ethical, practical, cognitive and emotional elements that surround the dissection experience. Females in the study tend towards a negative perception while males tend towards a positive one.

Doubler, Susan J.

Strand D

Monday, April 1, 1996
2:45 pm — 3:45 pm
Wabash Cannonball

Challenging Preservice Teachers' Beliefs About Science

Rebecca B. Corwin

This study reports on the results of the collaborative design of a preservice methods course in mathematics and science for early childhood teachers. The course was designed to challenge these graduate students' beliefs about mathematics and science. Students pursued their own mathematical and scientific investigations, reflected on their learning, and contrasted mathematics and science. They reflected on the nature of children's knowledge by interviewing young children, thus learning to pose questions that engage children's interests and show their understanding. Rather than integrating the two subjects in a topical approach, or treating them in separate compartments, the use of each as a backdrop for considering the nature of the other supported development of deeper understanding of the nature of each discipline. Findings suggest that a combination rather than an integration of the two domains heightens students' understanding of their nature as fields of inquiry. Because preservice students' ideas about science are somewhat more flexibly developed than their views of mathematics, conducting investigations of their own in combination with interviewing young students shows some promise as a collaborative approach to learning and teaching.

Dryden, Michael

Strand B

Monday, April 1, 1996
8:30 am — 10:00 am
Grand E

Use of Classroom Environment Instruments in Monitoring Urban Systemic Reform

Barrry J. Fraser

This study pioneered the large-scale use of classroom environment instruments in monitoring, stimulating, guiding and evaluating an urban systemic reform effort in science education. Adaptations of the My Class Inventory, Individualized Classroom Environment Research, Science Laboratory Environment Inventory, and Constructivist Learning Environment Survey were used and validated with a sample of over 22,000 elementary and secondary school students in Dallas. These surveys were produced in scannable form at a cost of only four cents per students. From a systemic perspective, significant drops in satisfaction with learning were found from elementary to middle school, although constructivist scales revealed a small increase in emphasis on constructivist aspects from grade 7 to 12. Few students expressed any shared control with their teachers over the learning environment, and differences in the class aggregate for most learning environment scales were found to be correlated with socioeconomic indicators.

Duffy, Maryellen

Strand A

Tuesday, April 2, 1996
10:30 am — 12:00 pm
New York Central

The Effect of Grouping and Two Instructional Strategies on Conceptual Understanding and on Critical Thinking Skills in Science

Dana L. Zeidler

The purpose of this study was to investigate and describe the effects of selected instructional strategies and grouping practices on conceptual understanding and critical thinking skills in a secondary biology classroom. The context of the study was the teaching and learning of plant nutrition in a secondary biology classroom. Conceptual understanding was assessed through a two-tiered multiple choice test developed by Haslam and Treagust (1987). The test was used as a pre-test and a post-test. The plant nutrition portion of The Critical Thinking in Biology Test was used to assess the critical thinking skills of the students. Classroom observational data was compiled using the Science Classroom Rubric (Burry, Sunal, Turner, and Pittman, 1993). Analysis of covariance and paired T-test results indicated that the grouping climate alone had a significant effect on conceptual change. The classes that were grouped heterogeneously scored significantly higher on the conceptual change test that those classes that were grouped homogeneously. No significant effects were found for critical thinking.

Duit, Reinders

Strand E

Monday, April 1, 1996
1:00 pm — 2:30 pm
Regency B

Educational Reconstruction of Key Issues of Theories of Deterministic Chaos

Michael Komorek

This paper is part of a paper set in which a model of educational reconstruction is presented. This model brings into balance issues of science content matter structure, of students' perspectives (e.g., students' alternative conceptions and their learning difficulties), and constraints coming from particular conditions of actual classroom teaching. It is illustrated that this model has a number of valuable issues when it is analysed whether it is worthwhile and possible to include a totally new topic (in our case chaos theory) into the curriculum. Several research studies, including hermeneutical-analytical work on elementary features of chaos theory, empirical studies on learning these features and evaluation of pilot instructional modules have shown that even grade 10 students (about 16 years old) are able to gain a deep understanding of the issue of limited predictability of chaotic systems and by this question ideas of predictability so far taken for granted. It appears that the model of educational reconstruction helped the researcher to understand in more advanced way both students' views and the science view of chaos theory as well.

Dundle, Rebecca A.

Strand G

Sunday, March 31, 1996
7:00 pm — 8:30 pm
Frisco

Is an Interactive Multimedia Program the Key to Strengthening Thinking Skill?

This study was completed to determine if the incorporation of the EcoVentures program, an interactive, multimedia science program, into a sixth grade gifted classroom would help promote the use of and strengthen students thinking skills. Reformers agree on the need for improvement and on goals that emphasize the development of conceptual understanding and higher-level thinking skills (Roth, 1989). Current reform envisions students being "minds-on" learners engaged in a highly interactive learning environment. Such an environment could be produced with the use of a multimedia program. This study focused on four students from a class of nineteen as they worked together comparing, analyzing, and discussing their answers to the "hands-on" lab activities and the interactive laserdisc activities accompanying the program. These activities became the foundation for the data collection. Data sources included the Whimbey Analytical Skills Inventory (WASI) test, audiotaping, and student interviews. The analysis of the three data sources revealed several factors that promoted the use of and strengthened students thinking skills. For instance, the program itself was not only "hands-on", but involved students in "minds-on" learning activities, and the program developers and I held similar views about learning and the nature of science.

Eichinger, David C. **Strand H** **Wednesday, April 3, 1996**
10:30 am — 12:00 pm
Wabash Cannonball

Learning About the Nature of Science: The Model Ecosystem Project for Pre-Service Elementary Teachers

This paper describes a study conducted in an undergraduate biology course for elementary education majors (n=260). Students in the class carried out a semester-long laboratory activity that was designed to teach biology concepts related to ecosystems as well as aspects of the nature of science. Based on analyses of students' pre- and post-instruction written answers to questions about the nature of science and students' written lab reports, this activity was found to be moderately successful in achieving these goals. Results show that many students maintained their realist and positivist perspectives on the nature of science. In addition, students perceived little similarity between their own engagement in the ecosystem activity and the work of "real" scientists. Implications of this kind of integrated science learning activity are discussed in light of these results.

Elliott, Thomas **Strand E** **Monday, April 1, 1996**
10:30 am — 12:00 pm
Regency B

Does Participation in an Undergraduate Methods Course Make a Difference?

Thomas Koballa **Joseph Riley** **David Butts**

The science methods course is a place to help undergraduates to develop both the skills they need to translate science concepts into meaningful experiences for children and toe build their personal confidence that they can be successful in achieving this important goal. During the 1994-95 fall and winter quarters, 92 undergraduates participated in a PACE evaluation of the science methods courses taught by four instructors. In this evaluation they described what they expected, valued and anticipated using from the course. Planning science instruction was the most frequently aspect in their expectations, valued outcomes and anticipated usefulness of the course. While students expected to build a rational for teaching science to children, by the end of the course, managing the learning experiences of children was more frequently mentioned. Concern for their personal knowledge base and confidence in teaching science was their second most visible aspect in their expectations and valued outcomes for the course. However by the end of course, it dropped to the least frequently mentioned aspect of their anticipated us. It would appear that once this goal is achieved, the student's focus was then on doing science with their children rather than be concerned about their ability to do it.

Enochs, Larry **Strand D** **Tuesday, April 2, 1996**
2:30 pm — 3:30 pm
Illinois Central

Science Teaching Self-Efficacy Beliefs: A Discussion of Preservice, Inservice, and Measurement Issues

Iris Riggs **Charlene Czerniak** **James Watters** **Gail Shroyer**

This session is in response to interest generated by a survey of NARST and AETS members regarding research on science teaching self-efficacy. The responses from this survey indicated that a number members were interested in organizing an active group to discuss and share information. The objectives of the session are as follows: 1. To discuss current research that deals with the science teaching self-efficacy; 2. To establish dialog among researchers; 3. To develop strategies for conducting research on science teaching self-efficacy. A brief panel discussion of science teaching self-efficacy beliefs research, including measurement and recent findings will be followed by a breakout session with groups broken down by topics; measurement; preservice; inservice; and qualitative assessment. A large group discussion will follow.

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Escalada, Lawrence T.

Strand G **Monday, April 1, 1996**
1:00 pm — 2:30 pm
Frisco

An Investigation on the Effects of Using Interactive Digital Video in a Physics Classroom on Student Learning and Attitudes

Dean A. Zollman

Interactive digital video provides students with control of computer visualization techniques and allows them to collect, analyze, and model two-dimensional motion data. Activities that utilize these techniques were developed for students to investigate the concept of frames of reference in various real-life situations. This investigation examines the effect on student learning and attitudes of using these materials in an introductory college physics course. The study measured students' computer attitudes and found improvement in students' feelings of comfort in using computers after completion of the activities. We found students' prior computer experience did not influence their perceptions of the activities. The majority of participants perceived discussion and the computer visualization techniques as being very effective in helping them learn. Students' understanding of the physics concepts were assessed and the participants' scores were compared with non-participants' scores. ANOVA statistical procedures revealed no significant differences between the two groups. This lack of difference could be attributed to the lack of instructional feedback given to the participants and the amount of time between the completion of the activities and the assessment.

Estep, Michele R.

Strand D **Sunday, March 31, 1996**
7:00 pm — 8:30 pm
Illinois Central

Teachers as Scientists? Examining the Effects of Teacher and Scientist Collaborative Teaming

Randy K. Yerrick

The purpose of this study is to examine the effects a collaborative scientific research project had on teachers' view of the nature of science. A total of five teachers (elementary, middle school, and high school) working with two scientists were studied in detail. Both groups carried out research for two weeks in the summer of 1995. One group of two teachers and scientist researched coastal geologic processes while one group of three teachers and scientist researched aqua cultural alternatives. Analysis of surveys, card sorting activities, and problem solving sessions were conducted with all participants. Shifts in teacher beliefs were observed in a.) perceived ultimate goal of scientific activity, b.) science as an evolving and activity producing tentative results, and c.) the subjectivity of scientists as individuals.

Falk, Joni

Strand D **Tuesday, April 2, 1996**
10:30 am — 12:00 pm
Frisco

Developing An Electronic Community to Foster Collaboration: Defining the Needs, Concerns and Issues of Prospective Participants

Jack Lochhead **Billy Spitzer**

TEECH is a three year project funded by NSF to foster increased collaboration among leaders in teacher development through participation in an electronic community. The following presentation reports on the results of a needs survey that was conducted to investigate the technical, social and contextual needs of participants. The survey was critical in understanding sub-communities, areas of interest, participants' current use of the Internet, and factors that would deter people from joining such a community.

Farr, Pamela L.

Strand G **Monday, April 1, 1996**
10:30 am — 12:00 pm
Frisco

Microcomputer-Based Laboratories in Elementary School Science

This experimental study examined the effects of Microcomputer-Based Laboratories (MBLs) on students' understanding of physical science (light) and life science (body systems and functions) concepts, expository writing skill in science-related areas, and epistemological views of the nature of science. In the six-week treatment, two groups of students at both the third grade level (N = 77) and the sixth grade level (N = 81) used identical MBL activities to explore grade-level specific science concepts. Half of the students at each level completed post-lab analysis by responding to structured prompts embedded in a specially-designed word processor called ScienceWriter, while the other half responded to unstructured prompts. Unexpectedly, factorial Analysis of Variance (ANOVA) revealed that while all students showed significant gains in science content knowledge following MBL instruction, there were no instances where students in the prompted groups showed greater gains than students in the unprompted groups. There were no gender differences at the third grade level, however, at the sixth grade level on all three measures there were significant differences favoring girls. It appears that when MBLs are utilized in an appropriate instructional context they have the potential to enhance science achievement and minimize gender bias in elementary school science.

Ferguson, Peter D.

Strand E **Monday, April 1, 1996**
4:00 pm — 5:30 pm
Grand E

The Role of School Size and Gender in Students' Perceptions of Science During the Transition from Elementary to High School

Barry J. Fraser

This study investigated students' perceptions of the generalist learning environment of the elementary school compared to their perceptions of the specialist science learning environment of high school. The role of student gender and change in school size as influencing factors were especially considered. The study was longitudinal with two data-gathering stages, one in grade 6 (the last year of elementary school) and the other in grade 7 (the first year of high school). Data were both qualitative and quantitative. The sample comprised 1,500 students from 47 feeder elementary schools and 16 linked high schools. The elementary schools ranged from isolated country schools, with a transition cohort of only 6 students, to larger city schools with hundreds of students. Five different school size pathways were defined for analysis: small-medium, medium-medium, small-large, medium-large and 'within school'. The 'within school' pathway involved schools with a k-10 structure, but with separate elementary and high school sites within the same campus. Results indicated both transition pathway and student gender to be influencing factors on changes in perceptions. Generally students perceived specialist high school science environments less favourably than the generalist elementary ones, however, perception of class satisfaction decreased for girls, but improved for the boys.

Ferguson-Hessler, Monica

Strand A **Monday, April 1, 1996**
10:30 am — 12:00 pm
Grand D

Experimental Investigation of Student Understanding in Physics: A Case Study

To stimulate active cognitive processing by first year students in Electricity and Magnetism, we designed a set of tasks involving classification of examples of concepts, analysis of problem situations, and planning of solutions, intended to support concept building and the construction of problem schemata. This case study investigates the actual effect of the tasks. A task analysis formed the basis for a systematic description of the types of cognitive activities required, and of the specific aspects of knowledge of concepts and relations used in the tasks, i.e. of the aspects of understanding relevant for these tasks. Four couples of students from the department of Applied Physics, whose performance in the domain varied from good to very poor, were asked to work through the tasks together, talking aloud and exchanging thoughts and arguments. Their dialogues were audiotaped and analyzed in terms of the types of process and understanding defined. All students did engage in the desired cognitive activities when the task required this. For the weak students however, the quality of their constructive activities was greatly hampered by lack of fundamental elements of declarative knowledge. Only good students demonstrated processes involving construction of problem schemata and using specific relations between concepts.

Fetters, Marcia K. **Strand B** **Wednesday, April 3, 1996**
10:30 am — 12:00 pm
Regency B

"Why Don't They Just Tell Us What They Want Us to Know?"

High school science teachers are faced with a difficult dilemma. How do you move high school students away from a view of science that is composed mainly of memorizing facts and rules? Reforms in science education call for the development of science literacy for all students. To meet this goal, students must move past the memorization of science knowledge and engage in the process of learning science. This paper explores four barriers to engagement in science activities: experiences in school, peer interactions, self-image as learner, images of science. This study took place in a heterogeneous biology class. Students were followed for one semester. Data sources included student interviews, daily field notes, classroom audio/videotapes and written work. One question facing science educators is: Is it possible to foster student engagement and develop science literacy effectively in heterogeneous classrooms? Academically successful and academically at-risk students often have different views of science and science classes. This paper provides insight into some of the barriers that influence student engagement and how teachers can address these views in a heterogeneous biology class.

Fife, Barbara **Strand G** **Monday, April 1, 1996**
2:45 pm — 3:45 pm
Frisco

Computer Assisted Concept Mapping and Analysis

Carl Berger

The purpose of this study was to compare knowledge of experts and novices by computer analysis of concept maps. An expert selected series of concepts and links was used. Students used a microcomputer program to move and link concepts in a familiar concept map arrangement. They could use each concept once but each link could be used multiple times. Data gathered were used to answer three questions: Are the same concepts on the maps connected? Are they connected by the same links? Are the links in the same direction? Three measures corresponding to these questions were generated and used to compare the maps. A fourth measure was generated to indicate the difference in maps that could be used to find clusters of misconceptions. As large amounts of data from maps could be analyzed quickly using the microcomputer, the program was used to locate common misconceptions or alternative conceptions not only of individual students but also of clusters of students. Given the constraint of teacher selected concepts and links, the use of a microcomputer program can reduce the tedious hand analysis of computer maps and can assist teachers and researchers in quickly finding and responding to clusters of alternative conceptions.

Fischler, Helmut **Strand E** **Tuesday, April 2, 1996**
10:30 am — 12:00 pm
Jeffersonian

The Atomic Model in Science Teaching: Learning Difficulties or Teachers' Problems?

The purpose of this investigation was to combine both the research areas "students' conceptions" and "teachers' thinking". In a grade 9 physics class a teacher introduced an atomic model to the students that was oriented at modern aspects of physics and dispenses with subsidiary planetary orbits. In a test, most of the students described the atom in terms of the Bohr model. This result caused an analysis of the teaching process on the one hand and of the teacher's conceptions of teaching and learning on the other. To identify teacher's beliefs and ideas about teaching and learning the repertory grid technique was applied which provides the details of his teaching intentions. Characteristic features of the teaching process were confronted with the teacher's construction of his content specific pedagogical belief system. The results of the investigation support the statement that many learning difficulties students have, when confronted with a modern atomic model, are caused by the teachers' problematic conceptions of learning and teaching and by their inadequate decision making in the course of the teaching process.

Fisher, Robert L.

Strand E

Monday, April 1, 1996
4:00 pm — 5:30 pm
Regency B

Project IMAST: Evaluating Integrated Learning

John A. Dossey **Vickie M. Williamson**

Project IMaST is an integrated mathematics, science, and technology curriculum developed for seventh grade students. The project, funded under an NSF Materials Development Grant, is housed at Illinois State University and is a product of the university's Center for Mathematics, Science, and Technology Education (CeMaST). During the 1994-1995 school year, the materials and methods of Project IMaST received a full field test in 10 junior high and middle schools across five states in the Midwest. The objectives of this evaluation program were: (a) To determine the impact of IMaST materials on students' achievement as measured through the Stanford Achievement Test's sections on mathematics concepts, mathematics applications, mathematics computation, mathematics total score, and science total score. (b) To determine the impact of IMaST materials on students' proficiency in problem solving, reasoning, and communication of solutions to extended open-ended problems graded via rubrics as measured by NAEP and items on the TIPS II from science education research literature. (c) To determine the impact of IMaST materials on students' attitudes and beliefs about mathematics, science, and technology as measured by a project developed attitude/belief inventory.

Flage, Lynda R.

Strand A

Sunday, March 31, 1996
8:30 pm — 10:00 pm
Regency A, B, C

Attitudinal and Cognitive Dimensions of Middle Grades Students Participating in an Open-Ended Inquiry Laboratory

This qualitative research study describes cognitive and attitudinal dimensions of middle grade life science students as a result of their participation in the open-ended inquiry laboratory (OEIL), Mystery Organism (M.O.) The study was a case study established in an ideal setting in which the subjects were a class of 6th graders at a private preparatory school. The OEIL was two-phased. During Phase I, students observed and documented the M.O.'s (Mellitobia - a parasitic wasp) lifecycle. In Phase II, students designed and executed experiments involving Mellitobia . The researcher acted as a participant observer and collected data by daily videotaping the class, audiotaping selected cooperative groups, collecting and evaluating all student artifacts. Data sources were evaluated for emergent patterns involving cognitive and attitudinal dimensions. The researcher found that students had positive attitudes towards the OEIL as a general strategy and towards the theme "M.O." in particular. Students displayed cognitive processes such as using analogies and generating wonderment questions and inferences. Students were able to generate open-ended research questions but were unable to design a controlled experiment. Furthermore, students displayed scientific attitudes such as independence, skepticism, questioning, wonderment, and preciseness.

Flick, Lawrence B.

Strand D

Tuesday, April 2, 1996
2:30 pm — 3:30 pm
Grand C

Relationship Between Student Perspectives on Inquiry-Oriented Teaching Practice and the Nature of Science

Norman G. Lederman **Larry G. Enochs**

The purpose of this study was to describe the relationship between teacher and student perceptions of inquiry-oriented teaching practice. In addition this study documented elementary student understanding of the nature of science. Three teachers who exhibited elements of recommended teaching practice were selected from the first cohort of 16 elementary and middle school in a four-year project for improving elementary science instruction. These teachers selected students they judged to represent a cross section of science achievement in their classroom. Twenty-seven students were interviewed concerning their perspective of their teacher's science instruction and on their understanding of the nature of science. Interview results were compared with data from the Constructivist Learning Environment Survey and Science Teacher Beliefs Instrument to generate a comparison of inquiry-oriented instruction from both teacher and student perspectives. Results indicate students have a reasonable level of knowledge about the nature of science and hold views that are consistent with those of their teacher concerning valuable elements of instruction. Implications are that elementary understanding of the nature of science can be taught indirectly and that specific models of inquiry-oriented instruction may not be as valuable to teachers as techniques for implementing general inquiry strategies.

Foley, Kathy

Strand B **Tuesday, April 2, 1996**
2:30 pm — 3:30 pm
Regency C

Mole Problems in Chemistry: Effects of Cooperative Learning and Visual Organizers

Angela O'Donnell

The purpose of the experiments reported here was to examine the effects of visual organizers and cooperative learning on students' abilities to solve single and multiple quantity mole problems in chemistry. Participants were high school students who were taught 3 units on moles in one of four instructional conditions; visual organizer only, cooperative learning only, visual organizers and cooperative learning, or teacher-directed. Results of two experiments involving over 200 students showed that the combination of visual organizers and cooperative learning was most effective in enhancing performance. Students who used visual organizers when learning the material reported that these organizers were helpful to them during testing and reduced their anxiety about the material. Students also reported that they enjoyed cooperative learning of the material. Students in the teacher-directed groups in both experiments had the lowest mean performance on a variety of tests.

Foulks, Barbara

Strand D **Monday, April 1, 1996**
8:30 am — 10:00 am
Illinois Central

Restructuring Elementary Science Instruction for Female, Rural, and Minority Students

Carolyn Butcher Dickman

This study describes an inservice project for third, fourth, and fifth grade elementary teachers that assisted teachers to construct effective science learning female, rural and minority students. The project was a year-long, holistic institute that supported the teachers' endeavor to learn current science content and appropriate pedagogy skills to retain the interest and participation of underrepresented groups in science. As the teachers participated in the summer workshop and two semester long follow up activities, data were gathered by transcripts of meetings, interviews, fieldnotes of observations, students interviews, lesson plans, and reflective journals. At the end of the second semester, the teachers developed training portfolios based on their observations and experiences during this year of training. These were used to train other teachers from their districts. Data analysis reflected positive changes in the perception and teaching practices of the teachers and in the attitudes of their students toward science. Implications are proposed which delineate the features of this project that promoted and supported changes in science teaching for underrepresented groups of students.

Fraser, Barry J.

Strand E **Monday, April 1, 1996**
10:30 am — 12:00 pm
Regency A

Development of Personal and Class Forms of a Science Classroom Environment Questionnaire

Campbell J. McRobbie **Darrell L. Fisher**

This study involved the development of separate personal and class forms a new classroom environment instrument which synthesizes salient dimensions from existing instruments as well as including relevant new dimensions. Personal forms are more appropriate for identifying differences between subgroups of students within a class and in the construction of case studies of individuals. Quantitative methods and qualitative methods were combined both in the validation phase and in several research applications. Following a pilot study, the questionnaire was administered to a sample of approximately 800 high school science students in 30 science classes. The study resulted in a new widely-applicable classroom environment questionnaire with similar statistical characteristics for the personal and class forms. It was found that: student perceptions on the 'personal' form were systematically less positive than their perceptions of the same class using the conventional 'class' form; gender differences in classroom environment perceptions were greater for the 'personal' form than for the 'class' form; and attitude-environment associations were of comparable magnitudes for the 'personal' and 'class' forms, although each form accounted for unique variance in attitude scores.

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Fraser-Abder, Pamela

Strand D **Monday, April 1, 1996**
4:00 pm — 5:30 pm
Grand B

Preparing Teachers to Teach in Multicultural Communities

This paper described a seven year university program for preparing teachers to teach in multicultural communities, among students who often belong to cultures which were foreign to the teachers. The overarching goal was to empower teachers to identify and find solutions to the complex educational problems they face in their science classrooms and to create innovative, effective and culturally relevant science curriculum and pedagogy. Strategies for increasing participation, interest and achievement in science among culturally diverse students, exposing teachers and students to the scientific enterprise and developing curricula for use with multicultural students were discussed. Major emphasis was put on sensitizing teachers to gender, cultural and psychosocial barriers to the acquisition of science and on improving science learning for all students by developing and teaching culturally relevant science curricula. Program developers have concluded that sustained implementation of successful teaching to multicultural students, lies with the reconceptualization of teacher understanding of the cultural backgrounds. Teachers must collaborate, corporate and communicate about classroom interactions, instructional strategies and the relationships between school culture and learning if all students are to be successful in science.

Frederick, Ronald C.

Strand E **Tuesday, April 2, 1996**
10:30 am — 12:00 pm
Jeffersonian

Status of Physics in Small Missouri High Schools and the Potential Applicability for Virtual Laboratory Utilization

Lloyd H. Barrow

The purposes of this study were to investigate the status of physics teaching in Missouri's small (≤700 students) public high schools, to evaluate the effectiveness of the Pilot Program of Virtual Laboratory Exercises for High School Physics, and to compare key characteristics of other physics teachers from small public high schools in Missouri to the physics teachers in the Pilot Program. Data for the statewide Survey Study were collected by use of a questionnaire completed by 103 volunteer physics teachers. Data for the Pilot Program study were collected from the physics teachers (N=25) from small Missouri high schools who participated in the implementation inservice workshops. All tabulations indicated that the inservice program was effective. When the Pilot Program teachers were compared to the Survey Study physics teachers, no significant difference was found in teacher background to teach or in the amount of emphasis placed on teaching six topics in Classical Mechanics, in the types of certificates held to teach physics, or in the number of physics courses taught during the 1991ñ92 school year.

Freedman, Robin Lee Harris

Strand E **Tuesday, April 2, 1996**
2:30 pm — 3:30 pm
Regency B

Changes in Assessment Practices of Teachers Participating in The Iowa SS&C Reform Project

The purpose of this study was to measure in what ways teachers change their assessment practices when they are a part of a science reform project. Instruments used to assess ongoing change included, journals, interviews, q-sort, and a pre and post test. Comparisons were made between a population of mixed teachers, pre-service teachers and teachers participating in a reform project. Results indicated that the population of mixed teachers used a smaller number of strategies in assessment practices. Statistical analyses conducted supported the aim of the project. During this session, we will discuss the nature of changes in assessment practices. The attendees to this session will have a change to participate in a quick q-sort and try out an assessment evaluation.

French, M. Jenice

Strand D **Tuesday, April 2, 1996**
10:30 am — 12:00 pm
Grand B

Pre-Service Elementary Teachers' Professional Development: Negotiating Power, Pedagogy, and Praxis

Margaret Bolick **Carol Borchers**

This action research was guided by a feminist-materialist theoretical framework that explores how power relationships predominantly based on gender but including race, class, and age were manifested in a preservice elementary science methods course. The course was taught by a female instructor and a female graduate student served as a participant observer. The primary means of data collection were open-ended questionnaire responses, audiotaped interview transcripts, transcripts of video taped classroom sessions, student journals, reflective sessions, and field observations. Data was coded and analyzed using constant comparative method. This action research is an ongoing exploration of the elementary preservice teachers' image of science, what marginalizes them in learning and teaching science, and the influence of feminist pedagogy on their perceptions of empowerment in science. Furthermore, we uncover ways in which power relations predominantly based on gender but including race, class, and age are either reproduced or resisted in the context of negotiation, narrative, dialogue, and critical reflection strategies.

Gabel, Dorothy L.

Strand C **Sunday, March 31, 1996**
7:00 pm — 8:30 pm
Wabash Cannonball

Action Research in Chemistry Classrooms: A Group Approach

Diane M. Bunce

This study examines the benefits reported by 12 high school chemistry teachers of participating in a modified group action research project and compares them to those expected to accrue from action research participation as given by Zeichner (1994). Specific questions included changes in terms of classroom practice, professional lives, confidence, personal theories of teaching, and disposition for future inquiry. The subjects were 10 high school chemistry teachers who had participated for two summers prior to the project in a workshop to update their chemistry background as either participants or instructors and two first year teachers. Data were analyzed using the constant comparison method in relation to the 14 questions that were identified as indicators of success in action research. Analysis of the data indicated that all the teachers greatly profited from this group action project. The benefits varied in degree and according to whether the teacher was an experienced or a first year teacher.

Gallagher, James J.

Strand C **Monday, April 1, 1996**
10:30 am — 12:00 pm
Missouri Pacific

Raising Teachers' Sights: Teacher Change in a School Community Environmental Education Project

Christopher Wheeler **Maureen McDonough** **Benjalug Soopokakit**

The purpose of this study was to monitor changes of teachers as they engaged in a pilot project designed to address the effects of deforestation in rural communities in Northern Thailand. Beginning in June 1993, twenty-three teachers in grades 5 - 8 in eight schools have been studied using ethnographic techniques. Baseline data on teachers' performance were collected prior to project orientation and staff development. Data also have been collected during four semesters of implementation on teachers, students, and school-community interactions . It was found that nearly all of the teachers have made significant changes in their instructional approaches and content since initiation of the project. Much instruction is based on local forest-related problems, using the community as a "laboratory" for study. As a result, interactions about forest-related issues between school children and adults in the community have been enhanced. Teachers are collaborating with each other and with community members in important new ways as the nature of forest-related environmental, social, economic, and policy problems are clarified. School and community members are working together to identify , evaluate, and implement resolutions to these problems. Implications for science educators will be discussed in light of new, broader standards.

Gallagher, James J. **Strand E** **Monday, April 1, 1996**
8:30 am — 10:00 am
Regency A

Initiating and Maintaining Continuous Assessment in Middle School Science Classes

Joyce Parker **David Sandys** **Dorcas Gonzalez-Lantz**

This interactive session will examine the changes that teachers must make when initiating continuous assessment in middle school science classes and their effects on classroom interactions and student learning. The work to be reported supports the assumption that teachers will be more effective when instructional decisions are informed by knowledge of students' understanding of science gained from continuous assessment. To begin discussion, university faculty members and teachers who have worked together in formulating and exploring continuous assessment strategies for selected topics in middle school science will summarize results of their activities. Key focus questions guiding discussion will include: 1. How do teachers become engaged in using continuous assessment in their classes? 2. What are the minimal levels of support that teachers need in order to initiate and maintain effective use of continuous assessment in their classes? 3. What are the effects of incorporating continuous assessment in science classes? 4. How are middle school science teachers able to maintain a sense of efficacy as they make the change from traditional to continuous assessment?

Gallard, Alejandro Jose **Strand F** **Monday, April 1, 1996**
8:30 am — 10:00 am
Grand A

Developing a New Language to Create New Visions for the Learning of Science and Limited English Proficient Students

Tobin and McRobbie assert that Australian science teachers are making pedagogical decisions below a threshold of consciousness because working with non-English proficient students is a relatively new phenomenon in this country. Immigration of non-English speaking students is not a new phenomenon in the United States. However, many patterns of science teachers' actions found in the U.S. Are also noted in Australia. Specifically, science teachers' actions are directed toward resolving a perceived gap between whom a student is (limited English proficient-LEP) and who they should be (fluent English speakers). I interpret the notion of consciousness of science teachers of LEP students as being at the threshold of consciousness. Science teachers' actions are at the threshold of consciousness because their decisions are framed within the notions of cultural and linguistic imperialism. Data sources include interviews from 10 Florida science teachers (K-12) about teaching science to LEP students. Additional data were collected during a week long meeting of science teacher educators, community college science teachers and policy level educators about learning science and LEP students.

Gattis, Kenneth W. **Strand A** **Tuesday, April 2, 1996**
10:30 am — 12:00 pm
New York Central

An Interdisciplinary Research Base for Investigating the Effectiveness of Demonstrations in Concept Teaching

How much a student learns in any instructional situation is affected by internal cognitive processes, personal interactions, and influences of the environment. Scholarly disciplines generally look at a learning situation from a certain angle. A research base from many fields of inquiry is needed to confront a problem in its entirety. In compiling a summary of such a research base for investigating the teaching effectiveness of demonstrations, it was found that the process of learning scientific concepts via demonstrations may be represented theoretically as: (1) the melding of formal and informal knowledge domains; (2) an ideational confrontation used in an attempt to get students to give up their naive theories in favor of accepted scientific ones; (3) an event that activates students' schemata; (4) the perception of visual images, which are processed and stored as naturomorphic representations and utilized differently than symbolic representations; (5) a witnessed event that is stored in episodic memory and carries a high degree of veridicality; (6) a technique for making comparisons between observed events and other events or concepts via analogy, literal similarity, or abstraction; and (7) an instructional device that, due to causal constraints on learning, is particularly effective in teaching concepts with spatial and temporal aspects.

Gee, Carrie J.

Strand C

Tuesday, April 2, 1996
10:30 am — 12:00 pm
Missouri Pacific

The First Year of Teaching: Science in the Elementary School

Dorothy L. Gabel

As part of the evaluation of a new teacher preparation program for elementary education majors with science as their area of concentration, developed as part of the Quality University Elementary Science Teaching (QUEST) Project at Indiana University, this study was conducted to examine the level of first-year teachers' science content knowledge, pedagogical knowledge, and pedagogical content knowledge. The case study subjects were 4 recent graduates of Indiana University who obtained full-time elementary teaching positions for the 1994-95 school year. Those specific aspects of each type of knowledge that were addressed in the teacher education program were examined. Qualitative and quantitative data sources included observations, interviews, and document collection. The overall findings revealed discrepancies in the teachers' stated beliefs and actual practices. While all of the novice teachers expressed confidence in their abilities to teach science to children, lack of time was identified as the greatest constraint during their first year of teaching.

Geiser, Helmut

Strand B

Monday, April 1, 1996
8:30 am — 10:00 am
Grand B

A Collaborative Cross-Cultural Look at the Effects of Television Use and the Structure of Everyday Experiences and Control Beliefs on Science Achievement and Science Problem Solving Among Fourth Graders in Germany and the USA

Robert H. Evans **Jurgen Baumert**

This study looked at the dependencies and relationships between television consumption and out-of-school experiences of fourth graders in two countries, their self-concepts, their willingness to attribute failures to effort or ability their academic achievement, and their success in solving certain scientific-technical problems. The total sample of 517 participants from Germany and the US was equal in mental ability and very similar in SES. Television use was assessed daily for two weeks by use of TV program schedules and a questionnaire. This procedure provided us with precise information about each program, including its content, placement in the day and time shared with other programs (channel surfing), as well as profiles of the usual television consumption of the children in our study. The data was analyzed by means of causal-analytical procedures (LISREL) with sufficient to good goodness-of-fit. The results showed no direct relationship between the use of television and achievement in school, but a direct negative relationship between television use and control beliefs in the technical domain. This suggests that any negative influence of television use on achievement in school is completely mediated through control beliefs in the technical domain.

Germann, Paul J.

Strand E

Tuesday, April 2, 1996
2:30 pm — 3:30 pm
Regency A

Student Performance on an Assessment of Science Processes: Recording Data, Analyzing Data, Drawing Conclusions, and Providing Evidence

Roberta J. Aram

The National Committee on Science Education Standards and Assessment (1993) viewed several science processes as important to an understanding of science as inquiry: formulating usable questions, planning experiments, conducting systematic observations, interpreting and analyzing data, drawing conclusions, communicating, and coordinating and implementing a full investigation. This study is one of three undertaken to develop research rubrics for a performance assessment of science processes and to evaluate seventh grade science students' ability to perform them. Specifically, this paper focuses on the processes of recording data, analyzing data, drawing conclusions, and providing evidence. Three hundred sixty-four field tested the Alternative Assessment of Science Process Skills (AASPS). Their responses were used to develop a research rubric and then this rubric was used to determine response patterns that could inform both instruction and assessment of science process skills. Only 61% of students performed the activity and recorded data successfully. Sixty-nine percent of students did not attend to the hypothesis in drawing their conclusion. Eighty-one percent did not provide specific evidence for their conclusion. These results were discussed in light of relevant theories and models as well as their implications for instruction and assessment.

Gess-Newsome, Julie

Strand D **Monday, April 1, 1996**
4:00 pm — 5:30 pm
Regency C

Conflicts, Mistakes, and Successes in Using Case Studies of Inclusion in an Elementary Science Methods Course

Sherry S. Demastes

This study investigated how preservice elementary teachers may best be prepared to handle diverse student populations within their classrooms in order to meet the challenge of science for all Americans. Case studies were considered an appropriate tool, but method of integration was at issue. Teaching strategies used in four elementary science methods courses taught over two consecutive years were compared. Of interest were course impacts on student attitudes toward inclusion and their knowledge of pedagogical techniques for targeting diverse learners. Specific instructional methods that highlighted inclusion included content interviews with elementary students, the discussion of cases related to inclusion, journal entries, unit plans, and case writing. First year results indicated that while students recognized that issues of inclusion made up a significant part of their teaching responsibility, they felt that this focus detracted from issues and content related to methods of teaching science. Students responded enthusiastically to the methods used the second year. Additionally, student generated lesson plans and science units showed an increased sensitivity to and awareness of teaching strategies appropriate for making science accessible to all the students in their diverse classrooms. The importance, process, and challenge of case study integration will be discussed.

Gibson, Adrienne T.

Strand B **Sunday, March 31, 1996**
7:00 pm — 8:30 pm
Grand B

Ninth Graders Talk About Conservation and the Environment

Scott A. Underwood William W. Cobern

The environment and conservation are important elementary school science topics. Indeed, these are legislated in the curriculum for Arizona schools. The researchers reasoned that to be environmentally conscious meant more that knowing a few concepts about science, the environment, and conservation. The researchers were of the view, one that is supported in the literature, that one's understanding of the environment is grounded in a deeper understanding of the essence of nature, that is, one's worldview. To investigate this the researchers used naturalistic interviews about nature. The analysis of interview transcripts led to two assertions: (1) Ninth grade students, even students with little grade success in science, articulate a high degree of environmental awareness. Student environmental awareness however, is often not connected with science. Student gender also was not connected with environmental awareness. Students typically cite either religious obligation or the need to protect resources as the reason for conserving nature. (2) Neither gender nor science grade success of ninth graders was found to be connected with the view that scientific knowledge can facilitate the use and conservation of natural resources. Student typically volunteered comments about the environment without reference to science.

Gilmer, Penny J.

Strand A **Monday, April 1, 1996**
1:00 pm — 2:30 pm
Grand D

Molecular Metaphor for Learning

Scott Engel

This paper presents a molecular metaphor for learning based on a thermodynamic study of the binding at equilibrium of monoclonal antibodies (mcAb) to lymphocytic tumor cell surfaces. The immune system and the brain have many parallels, both evolutionarily and functionally. For example, both systems can learn and remember. The immune system in humans can learn to recognize the chicken pox virus, if exposed to it. Humans also can learn using the brain. Both the brain and the immune system can remember the pattern observed, often a lifetime later. A pattern was noted between the binding of mcAb to cells and that of "concepts" binding to the brain. The antibodies used in the immunological work are bivalent. Under conditions in which the mcAb bind to the cell-surface with both "feet" down, many phenomena about learning ean be explained. These include forgetting memorized material, long and short-term memory, saturation, ideas solidifying overnight while asleep, deja vu phenomena, instincts, improvisation, pattern recognition, brainstorming, intuition, perception, etc.

Ginns, Ian

Strand D

Tuesday, April 2, 1996
10:30 am — 12:00 pm
Grand C

Science Teaching Self-Efficacy of Novice Elementary School Teachers

James Watters

The purpose of this collaborative project, involving science teacher educators, novice teachers and school administrators, was to analyze the reflections of two novice elementary school teachers for factors related to science teaching self-efficacy. Bandura's self-efficacy theory provides a framework for understanding important issues that could favourably predispose teachers towards the implementation of science lessons in the elementary school classroom. A psychometric test was used to monitor changes in self-efficacy, and rich descriptions of the two cases were obtained through semi-structured interviews. The results indicated that the maintenance or enhancement of self-efficacy is promoted by successful interactions with and positive feedback from children within a supportive school environment. Experienced teachers, school administrators and teacher educators must work together to develop this supportive environment in order to facilitate the implementation of worthwhile science lessons by novice teachers.

Glass, Merton L.

Strand D

Monday, April 1, 1996
8:30 am — 10:00 am
Illinois Central

A Naturalistic Study of Participants in an Innovative Graduate Program for Mathematics and Science Teachers

Barbara S. Spector

The research reported is based on a grounded theory, phenomenological, participant observation study. The purpose of the study was to identify critical beliefs and instructional behaviors characterizing teachers who completed the Graduate Program of Excellence for Mathematics and Science Teachers (GpEMSt). Reflecting national reform recommendations GpEMSt was composed of nine sequenced and articulated courses at a southeastern university. A residential summer program for middle school students was an integral part of GpEMSt. The study involved documenting the academic lives of three teachers from GpEMSt for a year. Eight categories describing teaching strategies and beliefs observed emerged. They are (1) each teacher used group activity in their teaching, (2) they believe that to learn, the student must have direct experience, (3) they had the students reason out answers to questions, (4) they related what was being taught to the "real world," (5) they believed that they were knowledgeable about the local educational environment, (6) they believed it was their option to deliberately choose what to include and exclude in their teaching, (7) they assumed that either there were multiple answers to problems, and (8) they seemed to do what they do because they care about students.

Glasson, George E.

Strand G

Tuesday, April 2, 1996
4:00 pm — 5:00 pm
Regency B

The Development of a Multi-Media Portfolio for the Authentic Assessment of an In-Service/Pre-Service Science Teacher Project

Woodrow L. McKenzie

The purpose of this study was to analyze the authentic assessment strategies that were utilized by in-service and pre-service teachers in an collaborative effort to develop a multi-media portfolio of curriculum development, teaching, and assessment activities. In this report, we described the learning of two collaborative groups of teachers: (1) geology professor, earth science teacher and algebra teacher in an effort to engage high school students in an interdisciplinary investigation of a local environmental problem; and, (2) pre-service teachers to develop authentic teaching experiences in a science methods class. The experience of these teachers was documented with the use of multi-media technology. In this process, teachers were involved in editing and selecting excerpts of their videotaped instruction. They also selected samples of lessons plans and student work for scanning and wrote reflection pieces to tell a story in the portfolio. Teachers were given the opportunity to reflect on their own learning and develop their unique "voice" concerning science teaching pedagogy. This research is significant because it provides information about an innovative process for engaging in-service and pre-service teachers in the assessment of their teaching using multi-media technology.

Golley, Priscilla S.

Strand C **Monday, April 1, 1996**
4:00 pm — 5:30 pm
Jeffersonian

The Nature of the Roles and Relationships in an Induction Mentoring Model

Patricia Daniel **John Wiggins**

This proposal assesses and describes the participants perceptions of the nature, roles and relationships of a Beginning Teacher Induction Program for beginning science and mathematics teachers that was developed as a collaboration between a large urban school system and a major research university in the Southeaster United States. Up to thirty percent of new teachers leave the profession due to feelings of inadequacy or an inability to cope with the problems of the beginning years. Induction or mentoring programs are designed to meet the needs of beginning teachers as they graduate from college and begin their first year as a teacher. The research study described by this proposal was designed to uncover how participants viewed their roles and relationships within the project. According to the results from this study, roles for team members need to be structured so that team members feel comfortable with the relationship. Implications for other mentoring programs suggest that clearly defined roles need to be agreed upon within a mentoring team, that the roles and relationships need to evolve over time, and that unnatural pairings cannot be forced. The research findings from this study indicate that voluntary mentoring relationships are more likely to produce positive results for the beginning teachers and mentors.

Gough, Annette G

Strand J **Monday, April 1, 1996**
8:30 am — 10:00 am
Burlington Route

Developing a Present Absence: A Feminist Perspective in Environmental Education Research and Practice

Since the earliest days of proclaiming an ecological crisis, scientists and environmentalists have been calling for environmental education as a means of resolving environmental problems. However, for the main part, feminists, and particularly ecofeminists, have not addressed environmental education as a strategy for achieving their goals. In this paper I report on my research into the gaps and silences present in policies, pedagogy and research in environmental education. The objectives of my research were to analyze the documents forthcoming from activities of the UNESCO-UNEP international environmental education program and the national UNESCO program in Australia--such as lists of participants at international conferences and authorship of publications--to determine whether women and other marginalized groups had been an absence in the formulation of the guiding documents of the environmental education movement and to determine the views of science and society implicit in these documents. Research methods were multiple: including surveys, content analysis and interviews. My findings were that women and other marginalized groups had been a minority presence in these significant events for the movement and that the views of science and society implicit in the documents were consistent with modern science and a technocentric view of society.

Gough, Noel

Strand J **Monday, April 1, 1996**
8:30 am — 10:00 am
Burlington Route

Rethinking the Subject: A Poststructuralist Analysis of the Construction of Human Agency in Environmental Education

This inquiry critically analyzes constructions of human agency in contemporary discourses of environmental education research, including the conceptual change/behavioral change discourse in which environmental education is construed as a form of science education and upon which this paper is focused. Methods of poststructuralist analysis are used to deconstruct examples of environmental education research texts with respect to what they reveal--and, more importantly, what they disregard, suppress, and exclude - concerning human agency. The analysis reported here demonstrates that contemporary discourses of environmental education research tend to reflect models of social interaction in which 'rational' behavior is assumed to follow from human actors pursuing their more or less enlightened self-interests in maximizing utilities and amenities or satisfying preferences. These discourses depict the particular forms of knowledge they privilege as being instrumental in enabling humans to pursue such 'rational' choices. But each of these discourses largely ignores the ways in which agency is produced by and within various societies, including our own. Yet the extent to which knowledges are authorized, and the manner in which they are (or are not) mobilized in the form of dispositions to act (or not), may be very sensitive to different cultural traditions, values and identities.

Graeber, Wolfgang K. **Strand B** **Monday, April 1, 1996**
10:30 am — 12:00 pm
Grand B

Interest in Chemistry — How to Promote Life Long Attention to Chemistry Related Problems

Although interest is of crucial importance for meaningful learning, it has hardly been investigated theoretically and systematically at school. It was only when scientific subjects lost in popularity and were not chosen as often at secondary level II, and when people became more and more critical of science and technology that educational research began to place more emphasis on interest. Within the framework of a cross sectional study, we collected data from 3203 pupils from different types of German schools on pupils' interest in chemistry, chemistry lessons and chemistry related out of school interest, and on those variables which influence interest. This paper presents the findings of a reduced subsample of 8th to 10th grade pupils who are beginning to take chemistry in grade 8. Findings show how strong the influence of "subjective" (self-concept) and "objective" (grades) achievement variables and a competent teacher are on student interest. Moreover, we confirm the distinct influence of emotional and value-related components. These results, together with imput from a group of teachers, will form the basis for developing and testing chemistry lessons which promote student interest.

Greenfield, Teresa Arambula **Strand F** **Monday, April 1, 1996**
1:00 pm — 2:30 pm
Grand F

Gender, Enthnicity and Science

Science achievement and attitudes were assessed for a series of students in grades 3-12 representing the four major ethnic groups in the state. It was found that more differences were accounted for by ethnicity and even grade than by gender; in addition, there was little interaction between ethnicity and gender. First, Caucasians and Japanese outscored Filipinos and Hawaiians at all grade levels, and the former two groups also expressed the most positive science attitudes and perceptions of scientists; younger students were more positive than older ones, and Hawaiians were least positive. Caucasians, and younger students, expressed the most positive perceptions of their own science ability and achievement. Second, there were no consistent gender differences in science achievement and very few in science attitudes and perceptions, although males held a more male-stereotyped view of science than did females, with some variation by ethnicity and grade. In addition, females were as or more likely than males to enroll in the most advanced science and math classes, but for both genders the major reason was college admission; Japanese students were most likely and Hawaiians least likely to indicate science interest as a reason. Findings are discussed within the context of cultural ecology and feminist social theories.

Griffiths, Noelle **Strand D** **Monday, April 1, 1996**
2:45 pm — 3:45 pm
Wabash Cannonball

What Does That Word Mean? The Role of Terminology in Science Classrooms

The purpose of this study was to examine the discourse in a general biology course offered to prospective elementary teachers. The science course was designed specifically to meet the needs of elementary education majors, and was a collaborative effort between the College of Arts and Sciences, and the College of Education. The course had a total of six instructors, and this study analyzed the science discourse and use of technical terminology, of one of those six instructors. Data for this study consisted primarily of video tapes of each class session, an interview with the professor, and a vocabulary list that was generated from transcriptions of the video's. The evidence suggested that (for this one professor) there was an emphasis on scientific terminology, and this created a language barrier between the students and the professor. This barrier made it very difficult for meaningful discourse to occur. At the start of the course, the students populated one community, and the professors populated another community, each characterized by their own discourse and language. Despite many attempts by both the professor and the student to cross the border between the communities, the language barrier proved to be too strong.

Gropengießer, Harald

Strand E **Monday, April 1, 1996**
1:00 pm — 2:30 pm
Regency B

Educational Reconstruction of Visual Perception

This paper is part of a paper set on a model of educational reconstruction. Visual perception is an interdisciplinary subject. A comprehensive theory contains at least physical, biological, psychological and epistemological aspects. Research in "vision" has mostly been conducted by physics educators and was merely concerned with conceptions of light and the relation between the object and the eye. The latter also forms an aspect of our studies, together with the biological concepts of perception and epistemology, physiology of sight and relations between eye and brain, physiology of the brain as well as cognition and psychic structures. Regarding the concept of "vision" empirical research into students' perceptions was conducted by problem centered interviews with 11 grade students as well as comprehensive scientific clarifications was carried out. The focus of the project was the interplay of components of the model of educational reconstruction. It is shown that students use several different conceptions of vision side by side. There is evidence that a constuctivistic view can help the students to handle the different conceptions as well as the corresponding scientific concepts in a meaningful manner.

Groves, Fred

Strand A **Monday, April 1, 1996**
4:00 pm — 5:30 pm
Grand D

The Relationship of College Student Perceptions of Global Warming to Four Demographic Variables

Ava Pugh

The purpose of this study was to determine college students' perceptions of the Greenhouse Effect as analyzed by gender, college assignment, race/ethnic group, and residency. Data were obtained from 348 undergraduate and graduate students from three academic domains: science, education, and liberal arts. On a Scheffé two-tailed t-test, significant relationships were found for race/ethnic group ($p < .05$), gender ($p < .0001$) and college assignment ($p < .05$). Whites scored higher than did the minority group, and males scored much higher than females. Liberal arts majors scored significantly higher than education majors, but showed no significant difference from science majors. No significant relationships were found for residency. Results imply that males understand more about these environmental issues than do females, and that the whites had a clearer conceptual understanding than did the minorities in this study. Education majors may be less well-read on these environmental issues than their liberal arts peers. A potential cause of misconceptions held by education majors may have been lack of understanding, as revealed by an earlier study of secondary school students.

Gunstone, Richard

Strand A **Tuesday, April 2, 1996**
8:30 am — 10:00 am
Jeffersonian

Observation in Science Classes: Students' Beliefs About Its Nature and Purpose

Filocha Haslam

This study explored the views of high school students about the nature and purpose of observations they made in their science classes. The primary data source constituted interviews with 37 students. A pencil and paper version of the interview schedule was also administered to a larger sample. The interview schedule was developed from extensive trial studies and from views of the nature of scientific observation found in the literature. The data suggest that (a) some students see observations as different in different areas of science, (b) content interacts with student motivation and engagement, (c) inference is not understood by students, and (d) the size of laboratory groups is a major influence on the way students approach the task of observing.

Guo, Chorng-Jee

Strand A **Monday, April 1, 1996**
1:00 pm — 2:30 pm
Grand B

A Study of The Images of The Scientist for Elementary School Children

Chia-Ling Chiang

The purpose of this study was to explore the images of the scientist for elementary school children, including in particular, how children define scientists, the nature of scientists' work, and factors which might influence the formation of the images of the scientist. A total of twenty-eight pupils of fifth and sixth grades were selected to participate in this study. They were initially asked to draw pictures and to write compositions about scientists, and then interviewed for further details regarding their images of the scientist. The findings were as follows: 1. The boundary with which pupils differentiated scientists from nonscientists was vague; 2. The values pupils placed on scientists were primarily for the well-being of mankind; 3. Pupils regarded scientists' activities with viewpoints similar to those held by positivists--that is, to see scientific research as absolute truth, and experiments as playing the role of proof or falsification; 4. Pupils' images of the scientist were derived mainly from mass media, especially scientists' biographies. They tended to infer from the message received, forming therefore the images of scientists by themselves.

Guy, Mark D.

Strand B **Monday, April 1, 1996**
1:00 pm — 2:30 pm
Wabash Cannonball

Collaborative Linkages to Create Culturally Relevant Curriculum

This paper reports on the development and implementation of a teacher enhancement/curriculum development project aimed at addressing and resolving science education issues involving Native Americans. The project represents a vibrant collaboration among a State University, a Medical School, five Tribal Community Colleges, and nine schools on or near Indian Reservations. The teacher enhancement component had a two-tiered approach involving leadership teams made up of Tribal College science faculty and teachers who conducted workshops for teachers at the local Tribal Community Colleges. Participants formed a state-wide network for supporting each others' efforts to use community resources and tribal elders to enhance the cultural sensitivity of the science curriculum. Program evaluation findings focused on the value of collaboration, time issues, support systems, and the importance of ongoing feedback.

Gwimbi, E. M.

Strand D **Wednesday, April 3, 1996**
10:30 am — 12:00 pm
Illinois Central

Elementary Science in Zimbabwe — Status of Process Skills in Teacher Training

S. Mugandani

The study examined whether experiences programmed for elementary science teacher trainees formed a sufficient basis for teaching Environmental Science through the process approach. It determined the extent of inclusion of process skills in college syllabi; training methods used at college and practical teaching assessments by college lecturers. Disposition of trainees towards process skills and inclusion of text analysis during training were also determined. Data was gathered through college syllabi; analysis of practical teaching supervision critiques and a student opinion questionnaire. Final year (123) trainees and 126 lesson critiques from three colleges were used. It established that: All aspects of syllabi except content in main subject, formed sufficient base for developing teachers with mastery of teaching science through processes; Trainees are positively disposed towards use of science process skills in their teaching; College teaching approaches did not sufficiently promote development of process skills in trainees; science text analysis was not done at colleges; lecturers did not sufficiently emphasise process skills while supervising trainees on teaching practice, and there was no significant difference in teaching science the process way between science majors and non majors. More practical approaches and syllabus interpretation at colleges and school based inservice were suggested as ways of enhancing teaching science through processes.

Hairston, Rosalina

Strand C **Sunday, March 31, 1996**
7:00 pm — 8:30 pm
Missouri Pacific

On Becoming a Constructivist Teacher

The purpose of this study was to analyze the science teaching practices of biology teachers who attended an institute where constructivist perspective was introduced and practiced. Nine teachers were observed and video taped teaching cell and molecular biology. Two instruments in the ESTEEM model were used, namely: the Science Classroom Observation Rubric helped to analyze the teaching practices and the Student Outcome Assessment Rubric provided student feedback related to the main idea, inquiry, and relevance of the lesson. Three raters (interrater reliability .87) evaluated the teachers and scored the lesson. The ratings revealed that all teachers scored high on facilitating the learning process from a constructivist perspective. However, several teachers were unable to vary their methods of instruction (44%) and to help students resolve their misperceptions (53%). The Student Outcome Assessment Rubric revealed that 33% of the teachers successfully conveyed the main idea of the lesson, 67% of the classes asked abstract questions and found the lesson relevant to themselves and 22% stated that the lesson was important to society. The teachers unanimously agreed that their transformation into a constructivist teacher is a challenging process.

Haley-Opiphant, Ann

Strand A **Monday, April 1, 1996**
1:00 pm — 2:30 pm
Grand B

Analyzing Students' Perceptions of Science as Inquiry: The Development of The "Scientists Doing Science (SDS)" Instrument and Assessment Rubric

Julie A. Dargart

Based on research of the physical image of scientists held by students, a diagnostic tool (Scientist Doing Science, SDS) was developed to assess students' level of understanding of science as inquiry. By analyzing pictures drawn at the beginning and the end of the 1994-95 school year, a criterion was established to evaluate the comprehension level of science as an inquiry process. The data collection tool instructed the students to draw a scientist doing science, giving the student the opportunity to expand from the stereotypical image of a scientist (i.e. lab coat, bespeckled, male, Caucasian). In order to clarify their illustration, students also included a caption describing the activity depicted in his/her picture. Upon the development of the SDS assessment rubric using naturalistic methods, a sample (n= 200) of the drawings were analyzed using the rubric in order to determine the overall level of inquiry represented in the drawing. The pre/post test comparison results showed a significant increase in the levels of students' view of scientists and their work.

Halloun, Ibrahim

Strand E **Monday, April 1, 1996**
10:30 am — 12:00 pm
Regency A

Views About Sciences Survey

David Hestenes

VASS is a survey of student views about science for the purpose of assessing their influence on learning. This paper discusses the survey's design, development, results and implications for science education. Student views are assessed along seven dimensions with a novel Contrasting Alternatives Design. In the last two years, VASS has been administered in 23 states to about 8,000 high school and college students enrolled in physics, chemistry and biology courses. The design of VASS and its results are compared to those of other published surveys. It is concluded that student views about science are major determinants of what students learn in science courses.

Hamilton, Beatrice

Strand B **Wednesday, April 3, 1996**
10:30 am — 12:00 pm
Regency B

Interactions between Students and Instructors in Higher Education Biology Laboratories

John Wallace

The focus for this study was a case study of a first year, introductory biology class at a small, Australian regional university. The group was taught by five staff and the major method of data collection was observation of all laboratory sessions for the same practical group over the semester's 13 weeks of classes. The observations were supplemented by interviews and a questionnaire. Grounded theory was used to analyze the data. The findings support much of the findings which have previously been made of secondary students or of university students in other disciplines. Many barriers to communication were identified, and the intentions and expectations or instructors and students were often poorly matched. A single most important finding fro the study is that more needs to be done to cater for the varying learning needs of individual students.

Hammrich, Penny L.

Strand H **Monday, April 1, 1996**
10:30 am — 12:00 pm
Burlington Route

Two Cultures of Teacher Preparation: Effects on Teacher Candidates' "World View"

Kerri L. Armstrong

The purpose of this study was to investigate the observation that teacher candidates majoring in elementary education exhibit a "world view" very different from students majoring in a science discipline while obtaining teacher certification in elementary education. The 40 teacher candidates in two different teacher preparation programs were asked to write a 3-4 page paper describing themselves as a learner in two different classes, one in which they do well and one in which they generally do less well. Analysis of the essays revealed the presence of two distinct cultures among students with regard to education and learning.

Haney, Jodi J.

Strand D **Monday, April 1, 1996**
8:30 am — 10:00 am
Grand C

Two Case Studies of Preservice Teachers' Beliefs Concerning Constructivist Teaching Practices in the Science Classroom

Julia M. McArthur

case studies were constructed for two preservice teachers who were purposely selected as a result of their high vs. low rank scores on the Classroom Learning Environment Survey (Taylor, Fraser, & White, 1994). The case studies provided insight into three primary questions: 1) what are the beliefs of the preservice science teacher regarding constructivist teaching practices, 2) how did these beliefs develop over a professional semester consisting of a six week science methods course and a ten week student teaching experience, and 3) are these beliefs consistent with the preservice teacher's subsequent classroom practice? Taylor, Fraser, and White's (1994) components of constructivist teaching were used as a theoretical framework in conjunction with Ajzen & Fishbein's (1980) components of the Theory of Planned Behavior. Data collection consisted of document analysis, classroom observation, and interviews. Data were analyzed using the constant comparative method. Findings from the case studies suggest that at least two kinds of beliefs were in operation: central beliefs and peripheral beliefs. The central beliefs were defined as those dictating subsequent teaching behaviors; whereas the peripheral beliefs were those that were stated but not operationalized.

Harrison, Allan G. **Strand A** **Sunday, March 31, 1996**
8:30 pm — 10:00 pm
Regency A, B, C

Science Students' Modeling Abilities and Mental Images of Atoms and Molecules

This interview-based ethnographic study probed 48 Grade 8-10 students' mental images of atoms and molecules and found that many of these students preferred models that are both discrete and concrete. Modelling is a powerful skill that defines much of the scientific method; however, most younger science students have difficulty separating models from reality. Language that is common to both biology and chemistry, e.g., nucleus and shells, is a major source of confusion for some students. Several students concluded that atoms can reproduce and grow and that atomic nuclei divide. Electron shells were visualised as shells that enclosed and protected atoms while electron clouds were structures in which electrons were embedded. These, and other alternative conceptions may be generated during discussion as a result of semantic differences between teacher and student language. Students expressed a strong preference for space filling molecular models and their conceptions of the models used in chemistry reveal much about the difficulties students' face as they try to assimilate and accommodate scientific ideas and terminology. It is recommended that teachers develop student modelling skills and that they discuss analogical models, including shared and unshared attributes, with their students.

Harrison, Christine **Strand E** **Tuesday, April 2, 1996**
4:00 pm — 5:00 pm
Regency A

Searching for Assessment Opportunities in Different Styles of Classrooms

One of the central beliefs in teaching and learning is that there ought to be communication channels to inform all interested parties about the progress being made, about successes achieved and problems encountered. However, in many learning environments communication systems only come into play at the end of the learning experience, rendering remediation or differentiation of the learning impossible. The traditional dominance of summative modes of assessment not only moulds the learning in many classrooms, but means that formative methods of assessment struggle for status and development. This paper begins to explore the opportunities for formative assessment in the classroom, the interplay it has with summative methods and some of the factors responsible for the weak development of formative approaches. The research evolved from an ethnographic study of one science class of 11-12 year olds, that was taught by two teachers with seemingly different teaching styles.

Hayes, Michael T. **Strand E** **Monday, April 1, 1996**
2:45 pm — 3:45 pm
Regency B

Power, Agency, and the Elementary School Science Curriculum

The purpose of this study was to investigate how a teacher negotiates the power relations underlying an elementary school science curriculum. Utilizing ethnographic research techniques within a case study format, one teacher was examined for the duration of one unit of study. The results indicate that the teacher, rather than simply reproducing asymmetrical social power relations, struggled with the historical, ideological and materials conditions which have shaped American schooling. These findings expand the social reproduction theories normally associated with sociological investigations of the curriculum and suggests that rather than being constrained by the social context of her classroom, the teacher utilized the historical, ideological, and material resources at her disposal to construct the science curriculum. Consequently this teacher's science curriculum bore both the traces of larger power relations, as well as her own distinctive stamp.

Helly, Maggie **Strand C** **Monday, April 1, 1996**
4:00 pm — 5:30 pm
Missouri Pacific

Becoming Centered: An Autobiography of a High School Chemistry Teacher

This autobiography case study tells my story as a high school chemistry teacher as I struggle to make sense of my personal teaching beliefs and practices. My story reveals my attempts to act consistent with my stated beliefs about teaching. "I looked at myself and found myself to be an unknowing conformist when what I want to be is a tireless inquirer. It is that change that I now pursue through self reflection and collaboration with others." In my autobiography focuses on my insights as I attempt to develop a constructivist epistemology. This study provided me with an opportunity to explore my beliefs about the educational system and to begin to look at the images of science that I acquired over the first 30 years of my life. Through the process of reflection and inquiry I learned several lessons: 1) The decisions I makes everyday in my classroom as a teacher are directly related to my beliefs; 2) I have the power within myself to alter those belief systems; and 3) By paying attention to feelings I can recognize internal signals that indicate internal conflict.

Helms, Jenifer V.

Strand H **Monday, April 1, 1996**
2:45 pm — 3:45 pm
New York Central

What Science Should We Teach? Teachers' Views on the Nature of Science and the Moral Dimensions of Science Teaching

This paper explores one aspect of the moral dimensions of teaching science. I take the view that questions of worth and purpose with respect to curriculum and instruction are essentially moral concerns and deserve careful consideration. This paper reports partial results of a dissertation study that explored teachers' perspectives on contemporary issues regarding the nature of science as described by historians, philosophers, and sociologists, and their meaning for science instruction. Working in a collaborative group, six teachers of different science subjects discussed and interpreted science in light of their classroom practice and their reading of the selected literature. In this paper, I illustrate the ways in which discussions about the nature of science provided the context for the teachers to explore their purposes for teaching science and what science they believed was most worth teaching, which are centrally moral concerns. Drawing on data collected from individual interviews, meetings, classroom observations, and collaboratively planned curriculum, I describe how the teachers addressed issues of worth and purpose with respect to teaching science through considering the questions "What makes something 'science'?" and "What do I want my students to learn under the classification, 'science'?"

Hennessey, M. Gertrude

Strand A **Monday, April 1, 1996**
10:30 am — 12:00 pm
Wabash Cannonball

Teaching from a Constructivist Paradigm: A Way of Knowing and Learning or a Case of "Pedagogical Tricks?"

Michael E. Beeth **Aletta Zietsman**

This interactive round table discussion addresses the question: Should teaching from a constructivist paradigm be considered a case of "pedagogical tricks?" The structure of the session coupled with nature of this topic has the potential to bring together, for the purpose of in depth discussion, perspectives which share a similar purpose and focus, but which may suggest different methods for fulfilling their purpose. From this interchange, we hope to gain insight into what counts as effective curriculum design, instructional sequences, and assessment strategies, that is, as components of an effective learning environment. We content that techniques employed by teachers, to become aware of students' thinking, or the methods employed to structure and re-structure students' thinking can, under certain circumstances, become a set of "pedagogical tricks." We feel that dialectic nature of this round table discussion has the potential to result in new constructions with which the participants can agree, not because the new constructions are "truer" than other of its predecessors but because it is better informed and more sophisticated. Each participant will outline their views on one or more of the issues as a prelude to an open discussion.

Henriques, Laura

Strand E **Tuesday, April 2, 1996**
2:30 pm — 3:30 pm
Jeffersonian

Can Parents Effectively Assess Their Children's Misconceptions?

Jennifer L. Chidsey

The purpose of this study was to ascertain parents' ability to find out their child's science misconceptions. Twenty-six elementary students were interviewed at home by their parents before beginning a science unit at school. Science educators interviewed these same students after parent interviews, but prior to instruction. Interview data were compared. The results indicated that both parents and science educators can elicit student misconceptions. However, the data obtained by the parents is less rich. It is speculated that this is a result of poor questioning skills. Parents failed to follow up incomplete or irrelevant responses.

Hicks, Bruno G.

Strand E **Tuesday, April 2, 1996**
8:30 am — 10:00 am
Regency B

The Use of Integrative Units as the Basis for Middle School Curriculum: Meeting National Science Content Standards

This study documents the integrative curriculum planning process as it is employed by a grade 6-8 team of teachers and students to generate the majority of their middle level curriculum. Data was gathered detailing the inner workings of the integrative process over a 20-day period for the three student groups of the grade 6-8 team, using the illuminative evaluation methodology described by Parlett and Hamilton(1976). Data was collected via classroom observation, interviews with teachers and students, and document collection. The study provides a descriptive analysis of an integrative curriculum and addresses the impact of the integrative curriculum on a middle school's ability to meet national science content standards. The study indicates that an integrative curriculum based on Beane's(1990) planning principles may be at least as effective at fulfilling middle level subject content requirements as the more traditional separate-subjects curriculum model. This is discussed in terms of the grade 6-8 team's ability to meet national standards in science, while allowing students the opportunity to participate socially and academically in the integrative process.

Hildebrand, Gaell

Strand B **Monday, April 1, 1996**
1:00 pm — 2:30 pm
Grand E

Writing In/Forms Science and Science Learning

This paper uses three nuances of "in/forms". Firstly, it argues that writing FORMS (or shapes) science and science learning through the textual practices which are available to interpret and allowable to produce. These writing genres shape science discourse and must be challenged because a) the available texts construct science as a rational field which "discovers" through the "scientific method"; b) the allowable genres construct science learning as recalling facts, processes and theories. Secondly, this paper describes a study where teachers included imaginative writing IN science learning: that is, as learning tasks. The focus is on poetry, anthropomorphic narratives and travel brochures as representative imaginative genres. Samples from students in three secondary schools are analysed and discussed in the context of students', and their teachers', perceptions of the impact on learning. Thirdly, this paper concludes that writing INFORMS (provides new insights into) science and science learning. Imaginative writing genres generate new ways of "thinking" science and teachers who use such tasks come to understand their students' learning in ways which teachers who rely on factual writing rarely can. Finally, it is argued that science itself has always been informed by imaginative writing: writing using metaphorical devices, allegories and imagery.

Holliday, William G.

Strand B **Monday, April 1, 1996**
1:00 pm — 2:30 pm
Grand E

More Than Just Science! A Science Teacher's Journey into the Realm of Reading and Writing

Maureen McMahon **Christine Kelly** **Gary Spinella** **Grace Benigno**
Donna Obermeier

The purpose of this study was to view the integration of reading and writing into a sixth grade science classroom in a suburban metropolitan school setting. The teacher as an agent of change was the main subject of the study. A reflective practitioner methodology wherein teacher interviews and field observation composed the bulk of the data was used as the main design. A documentation of the teacher's feelings about teaching science, hands-on science, integration of reading and writing into the science classroom, and his philosophy of teaching in general is detailed. The research revealed great insight into the tension a successful science teacher feels when challenged to move towards an integrated curriculum. Questions emerged such as "How can hands-on science activities remain a focus while integrating reading and writing as natural tools in the learning of science? Can reading and writing be an enjoyable part of science learning for middle school students? How can we be sure students are learning quality science as more and more integration of the curriculum is supported? The findings offer a window into a science teacher's world as he grappled with challenges to his prior beliefs and practice.

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Hsiung, Chao-Ti

Strand A **Monday, April 1, 1996**
4:00 pm — 5:30 pm
Grand D

A Study of Taiwan Elementary Students' Understanding of Ecological Stability

Jing-Yi Chang **Tung-Hsing Hsiung**

The present study combined qualitative and quantitative methods to inquire about Taiwan elementary students' understanding of ecological stability. A total of 812 elementary teachers from 342 schools completed a survey questionnaire and indicated that 54 concepts could be taught at elementary level. Results of 3,737 elementary students' achievement tests, however, showed that they only understood 32 out of the 54 concepts. The research team also observed three science classrooms for two semesters. Results showed that variations in meanings for the same word between real life and science contexts. Much attention is paid to definitions rather than understanding the meanings of scientific terms. The belief that "we are not a part of nature" was widespread in the students' conceptions, which definitely affected their understanding of ecological stability. Based on the current findings, educational implications and suggestions for further research are provided.

Huang, Hsiang-Wu

Strand A **Monday, April 1, 1996**
4:00 pm — 5:30 pm
Burlington Route

Influence of Immediate Observations on Students' Performance on Water-Level Problems

Yun-Ju Chiu

Two learning experiments designed to investigate the concept of water level were done on two groups of elementary and high school students. One experiment consisted three successive group tests. The second test of this series allowed each student to make immediate observations on the actual situations of the water in the jar. The other was a pure re-test experiment which consisted two group tests that were separated by a period of about one week. Results showed that: (a) immediate observations could help some students improve their performance on the problems when the jar was inverted or lying on one side, however most of these students retreat back to the original level of performance at the post test when observations were not allowed; (b) very few students could benefit immediately from the immediate observations when the jar was tilted at various angles, but many students showed delayed learning for this level of problems at the post test; (c) learning of the concept followed the same stage sequence as the sequence of natural development.

Huang, Hui-Ju

Strand A **Monday, April 1, 1996**
10:30 am — 12:00 pm
Wabash Cannonball

Progression in Genetics Conceptions: A Case Study of Knowledge Construction in the Classroom

The purpose of the study was to investigate the process of constructing genetics knowledge by examining how one sixth grade student's personal ideas of inheritance phenomena interact with classroom instruction. The student was interviewed twice (before and after genetics instruction) about the inheritance phenomena in an open-ended discussion environment. In addition, I participated in seven genetics lessons taught by classroom teacher. Before instruction, the student noticed various inheritance phenomena, such as similarity and difference between parents and children, yet he did not have ideas of genetics mechanisms. Later, the internalized memory of instruction became the student's core theory in explaining genetics mechanism. The student particularly talked about a paper clip activity to create a pair of chromosomes and the use of punnett square. In his memory, the activity was a system of three steps: combination, competition, and determination. First, two letters which represented parents' genes combined together. Next, there was an idea that two letters competed with each other and big letter "overpowered" small letter. Finally, the winner's trait was the determination of offspring's traits. However, he did not have a complete understanding of how parents' genes transfer to offspring, nor was he able to differentiate the level of phenotype and genotype.

Huang, Iris T.

Strand A **Sunday, March 31, 1996**
8:30 pm — 10:00 pm
Regency A, B, C

Effect of the Learning Cycle on Student Achievement and Attitudes in Elementary Natural Science

Hui-Lin Huang

The main purpose of this study was to investigate the effect of the learning cycle teaching strategy on natural science learning of fifth grade students in Taiwan. This study used a quasi-experimental design to compare the effect of two teaching strategies; a learning cycle approach and a traditional approach. The study inlcuded 8 classes, 350 students, and 4 teachers from 2 elementary schools in Kaohsiung area. The period of the treatment was ten weeks. The results indicated that the scores of experimental group were higher than the control group's in the instruments of the Third Formative Test, the High Cognitive Level Test, and the Attitude Toward Science in School Assessment. The information collected from questionnaires and interviews indicated that both teachers and students had positive attitudes toward the learning cycles.

Hudson, Sharon P.

Strand D **Tuesday, April 2, 1996**
2:30 pm — 3:30 pm
Wabash Cannonball

Broad Field Science Endorsements in the United States

Data on broad field science endorsements were collected from the State Science Supervisors in the fifty states. The response rate was 96%. Sixty-one percent of the responding states have one or more broad field science endorsements. The status of broad field science endorsements has changed significantly since Blank and Espenshade's 1988 study. In addition, this study reveals tremendous diversity in the grade levels and subjects covered by broad field science endorsements, and the names for these endorsements.

Hug, J. William

Strand J **Monday, April 1, 1996**
8:30 am — 10:00 am
Burlington Route

Prospective Science Teachers' Understanding of the Development of a Sense of Place Through an Environmental Science Methods Course

Lois M. Campbell

The purpose of this research was to understand the development of a sense of place in elementary and secondary science teachers during their enrollment in an environmental science methods course. The course curriculum included traditional pedagogical instruction along with extensive experiences in the natural and social communities in which the course was conducted. This research was conducted using a constructivist paradigm and a phenomenological framework. Qualitative research methodology was utilized. The researcher adopted the role of participant/observer, conducting observations and intensive interviews of the research participants. The participants kept written evidence of their progress in developing a sense of place through journal writing and other course related writing activities. Data were broken down into small units from which the research assertions emerged. Research assertions generated indicated that for these prospective science teachers their sense of place grew during the course. In some cases this was the result of reawakening of early experiences connecting with natural communities and forgotten while enrolled in college. In other cases, these were the first experiences in which the participants had been connected with the community as a part of their formal education.

Hurst, Roy W.

Strand D

Tuesday, April 2, 1996
8:30 am — 10:00 am
Missouri Pacific

Assessing the Long-Term Impact of an Enhancement Program for Life Science Teachers

The purpose of the study was to assess the impact of a teacher enhancement program on the participating teachers and their students in terms of its effect on their instruction and the classroom environment, as well as to evaluate the program's impact beyond the participants' own classrooms. The Individualized Classroom Environment Questionnaire (ICEQ) was administered to participants during the workshop in two forms, one to assess their actual classroom environment and one to assess their preferred classroom environment. Participants were also surveyed as to how they intended to apply workshop activities in their classes. The ICEQ and surveys were administered again at the conclusion of the school year. There were significant ($p<.05$) changes in the classroom environment, with classes coming to more closely resemble the teachers' preferred environment. There was an increased emphasis on the skills and processes of inquiry and their use in solving "real world" problems. All but one participant had presented workshops for other teachers, with a mean outreach of 14 teachers per participant. Twenty or more workshop activities were used by 75% of the teachers and 83% reported "considerable" or "great" changes in their teaching.

Jackson, David F.

Strand G

Tuesday, April 2, 1996
10:30 am — 12:00 pm
Frisco

Internet Resources for Middle School Science: Golden Opportunity or Silicon Snake Oil?

Gretchen Bourdeau **Thomas J. Hagen**

This study examines the experiences of nine teachers at three schools in learning about telecomputing and planning to implement or enhance project-based learning in their middle school science classrooms using a variety of resources available through the Internet. Data were gathered during a summer inservice workshop and include field notes, text and multimedia documents produced by the teachers, and electronic mail communications between teachers, scientists, and science education faculty involved in the project. Plans generated reflect a variety of concerns and rationales and include: joining existing, open-participation collaborative projects; newly organizing a network of teachers to share and compare geologic and hydrologic field data; using teacher-created multimedia presentations to enhance teacher-centered learning activities; consciously comparing the value of books in the school library, videodisc and CD-ROM databases, and the Internet as information sources for student reports; and the "value added" by Internet resources in an existing project-based curriculum organized around critical consumerism and environmental issues. As a result of their experience, all of the teachers are conscious of the problems created by both the nearly unlimited quantity of information available on the Internet and the limited quality and relevance of much of that information.

Jarrell, Ranald

Strand D

Tuesday, April 2, 1996
10:30 am — 12:00 pm
Grand B

Factors Influencing the Self Efficacy of Elementary Preservice Teachers as Science Educators: Science Education Methods Courses, Current Knowledge of Science, and Subjective Explanations of Past Science Performance

Peter Rillero **William Cobern**

This study investigated factors that might affect the level of self confidence of preservice elementary, special education, and early childhood teachers as they approach their teaching of science. It was hypothesized that preservice teachers' self confidence was most likely affected by both antecedent factors and their experiences in science teaching methods courses. It was further hypothesized that the most influential antecedent factors affecting preservice teachers' self confidence as science teachers were their subjective beliefs about themselves as learners of science and the level of general science knowledge they brought with them into their science methods courses. This presentation describes a three semester investigation of these variables with 215 preservice elementary, special education, and early childhood teachers.

Jarvis, Tina **Strand A** **Monday, April 1, 1996**
2:45 pm — 3:45 pm
Jeffersonian

Testing a Model of Children's Conceptions of Technology

Léonie J. Rennie

A theoretical model was produced describing the development of children's conceptions of 'technology'. The model was based on the analysis of 81 children's interviews and 315 second to sixth grade English children's responses to three instruments designed to elicit their perceptions about technology. This paper reports testing the generalizability of the model with data from 871 Western Australian children responses to the same instruments and interviews with a subsample of 186 children. A five stage hierarchical structure was confirmed. The Australian and English children had a similar range of concepts to explain technology, but the frequency of concepts varied. The major conclusions are that the model is generalizable, the pattern of conceptual development in the two countries is similar, but the type of concepts held by individuals, particularly in the early and middle stages, are curriculum or context dependent. The model allows for pedagogical strategies to assess and accelerate children's conceptions of technology in particular, and in general to assist children to develop abstract ideas in science and other subjects. Increased knowledge of children's ideas of technology also assists in minimising pupils' possible confusion between science and technology.

Jbeily, Kamil A. **Strand D** **Tuesday, April 2, 1996**
10:30 am — 12:00 pm
Illinois Central

Exploring Issues in Collaborative Professional Development for Science Teachers

The Regional Collaboratives for Excellence in Science Teaching is supported by the Dwight D. Eisenhower Science Staff Development Program, Texas Education Agency. The Collaboratives are designed to address the needs of teachers in Texas schools and the needs of the underrepresented in order to ensure greater access and participation of females, minorities, students with limited English proficiency, the economically disadvantaged and individuals with disabilities in science education. During this paper presentation, the seven major functions of the Regional Collaboratives program will be presented, and examples of collaborative partnerships will be described. The teacher and student populations served by the Texas Collaboratives will be summarized, and a synopsis of the results of needs assessments conducted across the state will be presented. Recent activities of the Regional Collaboratives will be outlined, including the two annual meetings of the Texas Regional Collaboratives for Excellence in Science Teaching. The First Annual Meeting of the Regional Collaboratives for Excellence in Science Teaching, held in April of 1994, focused on the structure and function of collaborative science professional development projects, facilitators and barriers to linking collaborative partners, and the incentives and structures for attracting and engaging teachers in collaborative activities. The Second Annual Meeting of the Regional Collaboratives was held in July of 1995, and emphasized the establishment, assessment, and information dissemination for Regional Collaboratives. Highlights of these meetings will be shared.

Jeffrey, Kodi R. **Strand J** **Sunday, March 31, 1996**
7:00 pm — 8:30 pm
Burlington Route

Visitor Understanding of Interactive Exhibits: A Study of Family Groups in a Public Aquarium

James H. Wandersee

The purpose of this study was to determine the effectiveness of five interactive exhibits in the New Orleans Aquarium of the Americas. Fourteen family groups were tracked as they visited the exhibits. They were then interviewed. One to two months later, families were called for follow-up interviews. All interviews were recorded and transcribed. Interviews were analyzed for memories of the interactive exhibits. Memories were categorized based on whether visitors could describe the exhibit, name animals that were part of the exhibit, and provide additional information learned from the exhibit. Often visitors could remember something learned from the exhibit, as well as physically describing it. Although all exhibits were remembered fairly well during the short term interview, three of them were recalled particularly well. During the follow-up interviews, visitors had very high recollection of those same three. They had almost no recollection of the other two. Principle differences between the memorable and non-memorable exhibits involved differences in the exhibits' emotional impact.

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Jegede, Olugbemiro

Strand B **Monday, April 1, 1996**
2:45 pm — 3:45 pm
Grand B

The Validity of the Science Student Stress Inventory Using a Sample of South African High School Students

Prem Naidoo **Peter Okebukola**

The literature on science teachers' stress is still scanty while nothing is available on science students' stress. A logical beginning step would be the need to find a valid instrument which is capable of identifying stress among science students. This study therefore, sought to find a valid and reliable instrument for identifying the factors or groups of factors perceived as bringing stress to bear on secondary level science students. An instrument, the Science Student Stress Inventory (SSSI) developed by Jegede and Okebukola in 1994 was validated using a selected sample of 188 South African secondary school students selected through stratified sampling technique. SSSI which showed an initial stability coefficient of 0.83, yielded a Cronbach Alpha reliability co-efficient of 0.95 and Inter-group Spearman correlations of between 0.21 and 0.71 ($p < .001$) for the subgroups within the instrument. An original 50-item instrument has been reduced psychometrically to 47 items and the factor analysis confirmed the subgroups in the original development with a redistribution of items. The science students in the sample regarded the "fear of scoring low marks in science examinations and assignments" and "studying science forces me to behave like a scientist" as the most and least stressful factor respectively.

Jensen, Murray

Strand A **Wednesday, April 3, 1996**
10:30 am — 12:00 pm
Regency B

Investigating the Disney Effect: Are Students Reluctant to Apply Natural Selection Principles to Life Forms with Which They Identify?

John Settlage, Jr. **A. Louis Odom**

This study was designed to investigate whether a student's responses to test questions about natural selection were influenced by the extent of the student's identification with the organism. The hypothesis was that a student would be reluctant to invoke the ravages of natural selection upon species with which they posses a greater empathy than upon species about which they cared less strongly. College students in a general biology course at a major research university were administered a twelve-item multiple choice test to assess the extent of their understandings of natural selection. The test consisted of six parallel items where the only difference between the items consisted of the type of organism described. Students were then asked to individually rank lists of organisms according to two criteria. One criterion was the relative "appeal" of each organism and the other criterion was how relatively "advanced" the students regarded each organism. Analyses were conducted to evaluate whether students made disproportionately greater errors on those items that described organisms with which they more closely identified.

Johnson, Judith

Strand D **Sunday, March 31, 1996**
7:00 pm — 8:30 pm
Grand C

Change Is Learning Something New: Teacher Research and Systemic Reform in Science Education

Beth Farina **Larry Meadows** **Mary Neal** **Terry Nelson**
Malinda Ponton **Julie Townsend**

The purpose of this interactive session is to provide a window into the thinking and learning of teachers who have completed an intense program of study designed to facilitate the collaborative, systemic development of research-based, innovative science and mathematics educational practices in K-8 classrooms. Teacher research is the foundation of the Lockheed Martin/University of Central Florida Academy for Mathematics and Science, and therefore the focus of the session will be to learn from these researchers about how this model project is supporting and promoting systemic change in the schools in this state.

Johnson, Judith

Strand D

Monday, April 1, 1996
8:30 am — 10:00 am
Illinois Central

On-Site Inquiry: Real Hope for Science Education Reform

Response to the calls for reform in mathematics, science and technology education resulted in the initiation of an innovative project at the University of Central Florida. The Lockheed Martin/University of Central Florida Academy for Mathematics and Science is an education/industry/community partnership aimed at improving mathematics, science, and technology education in Florida. The focus of the Academy is to promote the support and implementation of science and mathematics educational reform initiatives. Teacher research is the foundation for the Lockheed Martin/UCF Academy program that is designed to facilitate the collaborative, systemic development of research-based, innovative educational practices. The purpose of this study was to learn about the short- and long-term impacts of an intensive program of study aimed at science and mathematics educational reform. The methods of data collection were designed to illuminate the thinking and reflections of Lockheed Martin Academy Scholars, their school administrators, and university faculty involved in the project as well as the trends in standardized test scores from schools in which Scholars teach. Findings indicate that teacher research is the vital link to systemic reform in science education.

Johnson, Sally

Strand D

Monday, April 1, 1996
8:30 am — 10:00 am
Jeffersonian

Exploring Issues of Success: A Consideration of Some of the Outcomes of the Nigerian Integrated Science Teacher Education Project

CA Harrison

Many teacher development programmes start from the premise of a common understanding about aims, intentions and indicators of what will constitute success within a project, without recall to effects on individual personnel or institutions. This paper examines the extent to which this has been demonstrated within one Nigerian project, through looking at some of the less expected outcomes of the effects of training. It considers the factors responsible for this and offers insights which may be useful to future teacher education programmes in developing countries.

Johnson, Valora M.

Strand F

Wednesday, April 3, 1996
10:30 am — 12:00 pm
Grand A

Gender and Ethnicity: A Case for Writing-To-Learn Physics

This research focuses on the feasibility of using writing-to-learn assignments in an undergraduate physics course. It was based on the hypothesis that positive student attitudes impact the degree to which writing-to-learn assignments can be implemented in undergraduate physics courses. Differences in attitudes will be exhibited based on gender and ethnicity. Sixty-three undergraduate physics students were involved in this study. Fifty males and thirteen females participated. There were two Asians, two African-Americans, forty nine Caucasians, two Hispanics, two Indians and six who did not indicate ethnicity. The questionnaire contained ten statements in which subjects were asked to rate each statement on a five point scale from one (strongly disagree) to five (strongly agree). The research provided valuable insight on the perceptions of ethnic groups and college majors. Even though writing-to-learn may not be feasible for implementation into all undergraduate physics courses, it may prove beneficial for students of varying majors and ethnicity who need tutoring. This study has reflected what is already known about writing-to-learn, that it may only be effective in certain environments and under certain conditions.

Jones, Gail

Strand C

Tuesday, April 2, 1996
2:30 pm — 3:30 pm
New York Central

Situated Science: Defining Science in the Context of School Reform

Elizabeth M. Veslind

In order to investigate how science education reform is translated and implemented in practice we conducted an interpretive case study of two schools that were participating in a state-wide project called the "Statewide Improvement In Elementary Mathematics and Science Instruction Through Peer Teacher Training." Two researchers followed the project for one year and collected field notes, documents, and interviews from lead teachers, other teachers, principals, project instructors, and parents. Results showed that there was a universal belief that science should be taught as "hands-on" instruction. Hands-on science was implemented as learning styles, science activities, problem-solving, nature study, show-and-tell, integrated instruction, and art processes. Efforts to reform the science programs at these two schools were highly influenced by the variety of meanings and interpretations of goals for science teaching held by the teachers and administrators. Educators at these two schools took the common goal of "hands-on" instruction and found personal meaning that was consistent with existing practice.

Jones, Leslie S.

Strand F

Tuesday, April 2, 1996
4:00 pm — 5:00 pm
Missouri Pacific

Promoting Inclusiveness and Counteracting the Underrepresentation of People of Color in Science Education

There is growing recognition that one constituent of the science education reform process must be sustained effort toward making the study of science accessible to more people. This presentation will highlight research on the efficacy of employing deliberate intervention strategies for this purpose. The presence of a large group of academically-talented, urban, racial/ethnic minority students on the campus of a land-grant university provided the incentive to develop an informal science education program. The effort addressed deficiencies in agricultural literacy while recruiting nontraditional students for the College of Food, Agricultural, and Environmental Sciences. Students were surveyed before and after their field trips and additional information on their impressions of the experience were taken from essays written as an integrated science/writing experience. The opinions of collaborating agricultural scientists and program teachers were assessed and compared to compiled field notes. The successful effort to reshape the traditional presentation of agriculture was demonstrated in the testimony of the students and the observations of the adults involved. The initiative showed the possibility of addressing the dual challenge of opening the doors of science while simultaneously cultivating the interest of historically underrepresented people in nontraditional subject areas.

Kahle, Jane Butler

Strand C

Monday, April 1, 1996
8:30 am — 10:00 am
Missouri Pacific

Research Demanded by Systemic Reform: Multi-Level Analyses of Interpretive Data

Ken Tobin

Interpretive research seeks to find compelling answers to broad questions. Accordingly, the methodology is most suitable for a study of the process of reform and the manner in which reforms are, or are not, enacted. This study employed a multi-level design in the sense that data were collected from the state, district, school, class, and individual. Furthermore, both quantitative (surveys and tests) and qualitative (site visits and interviews) were obtained because of the desirability of assessing a diverse set of qualitative and quantitative sources in a given study. During this section, the political and logistical realities of a state-wide assessment will be presented. In addition we will examine issues of framing data and making interpretations across the levels of the study so that central tendencies are ascertained and the diversity of viewpoints are retained. The presentation will address issues of authenticity and the credibility of interpretive studies that employ a multi-level design. The search for meaning across those levels will be described.

Kamen, Michael **Strand B** **Monday, April 1, 1996**
10:30 am — 12:00 pm
Grand E

An Analysis of the Role of Language in Science Learning: Issues Related to Learning Science in a Second Language

Stephen Marble **Larry Flick** **Nancy Davis** **Wolff-Michael Roth**
Marissa Rollnick **Kathie Black** **Thomas Destino**

Members of the Special Interest Group on the Role of Language in Science Learning will present an interactive session to explore the role of language in second language science learning. A videotaped segment of a classroom science lesson in which students are learning science in a language other than their native tongue will be shown. Each panelist will present an analysis of the use of language in the lesson indicating specific issues and how they relate to a theoretical perspective, research, and the classroom teacher. The session will include a discussion about the role of language in the teaching episode viewed. The videotape will be shown and transcripts and the paper will be available.

Kamen, Michael **Strand J** **Monday, April 1, 1996**
8:30 am — 10:00 am
Burlington Route

An Environmental Education Field Trip Integrated into an Elementary Science Methods Class: Meaning of the Emerging Teachers

Randy Cromwell

The preparation that elementary education majors receive in environmental education is varied and often inadequate. For those students who do receive it the most common form of environmental education preparation is probably the inclusion of Project WILD into a science methods course. This paper describes and documents the experiences of a group of elementary education majors who participated in an overnight Project WILD training and outdoor/environmental education field trip. This trip was part of the requirements for students in a block consisting of science, math, and social studies methods. Qualitative data were collected by direct observations during the trip, in-depth interviews with several students during the quarter, and conferences during the field experience. Students completed a questionnaire before and after the trip. The questionnaire included a request for them to draw a naturalist. Some students saw personal and professional growth. Others began to see the process of teaching and learning science in a new way. And some simply learned activities and discovered resources. Yet, for everyone on the trip, they had a shared common experience which contributed to a supportive atmosphere during the quarter.

Kattmann, Ulrich **Strand E** **Monday, April 1, 1996**
1:00 pm — 2:30 pm
Regency B

A Model of Educational Reconstruction-Theoretical Foundations

Reinders Duit

The model presented comprises the following three components: (1) Analysis (and clarification) of content structure; (2) Empirical investigations on students' conceptions, (3) construction and evaluation of instruction. These three components are intimately interrelated. The model therefore allows to develop curriculum modules in such a way that onesidenesses, i.e., focus on science matter structure or on students' perspectives, may be avoided. Science content structure, students' learning difficulties, and learning constraints coming from the particular teaching/learning conditions in actual classroom practice may be given equal attention. Also clarification of science content is significantly supported as it is a key assumption of the model that the researcher's understanding of subject matter structure improves considerably if viewed from the perspective of students' conceptions. A constructivist epistemological view of science knowledge and students' knowledge construction is taken. The model and its theoretical foundations (e.g., its basis in German tradition of "Didaktik") will be outlined. Examples for the model in practice will be provided in subsequent papers presented at the same session.

Katz, Phyllis **Strand J** **Tuesday, April 2, 1996**
4:00 pm — 5:00 pm
Regency C

Novice and Veteran Informal Science Teachers: Two Preliminary Case Studies of Participating Mothers

This study sought to investigate the participation factors for both a continuing and new "adult leader" in the HOSO (Hands On Science Outreach) after school informal science program. Theoretical foundations in "parental investment" and constructivism guided this work. Both participants were mothers who received the standard training, written guides and kit materials to lead their groups for the eight week program. Data were gathered to establish a profile for each woman, including her beliefs about science, the role of science and the role of "parent-as-teacher." The qualitative methodology included semi-structured interviews, class observations, questionnaires, drawings and journals. The study found similarities in interest in children, science and the value of science. There were differences in style, class preparation and management. Direction for more extensive study is drawn from this preliminary work.

Kelly, Christine **Strand J** **Monday, April 1, 1996**
2:45 pm — 3:45 pm
Regency A

Daily Choices and Consequences as Seen through an Environmental Lens: Examining Individuals' Envioronmental Responsiveness

As the future of the natural environment is in question, it is important to understand and learn from individuals' responses to the environment and environmental information. To date, few researchers have investigated the constructs that influence an individual's environmental responsiveness using methodologies other than self-report surveys. It is the aim this study to employed grounded theory methodologies to investigate the constructs embedded in individuals as they respond to environmental impacts, to environmental responsibilities, and to human beings' relationship with the natural environment. The research findings of this study culminated in the identification of different types of environmental responses as they relate to daily environmental actions and the perceived task difficulty of achieving desired environmental end-results. The major assertion generated from the comparison of the emerging categories is that complex relationships exist between prior knowledge, affective responses, human agency, efficacy expectations, causal attributions and the western societal structures and expected standards of living as they related to the daily environmental responsiveness.

Kerner, Nancy **Strand G** **Monday, April 1, 1996**
1:00 pm — 2:30 pm
Frisco

Use of Data Modeling in Designing Interactive Chemistry Laboratory Software

Carl Berger **Charles Dershimer** **James Penner**

The purpose of this study was to use data modeling to assist in the development of a microcomputer supported chemistry instructional program. An introductory chemistry course was used as the basis for the development of a data rich students collaboratory lab experience. Data Modeling or Case * Method Entity Relationship Modeling was used to so that the curriculum developed could be disseminated and other colleges and universities could design a similar course but tailor it to their unique school or chemistry course. In this case study we describe the process used in business and engineering that was adapted for use in this curriculum design process. With the support of the Information Technology Division of the University of Michigan, entities, relationships and processes were identified and modeled. By carefully following the data modeling methodology we were able to save many hours as we developed the curriculum. We share the technique and also discuss the successes as well as pitfalls of using data modeling (currently popular in information technology) for developing technologically supported science curricula.

BEST COPY AVAILABLE

Kesidou, Sofia

Strand E **Tuesday, April 2, 1996**
10:30 am — 12:00 pm
Regency A

Designing Curriculum Materials to Serve Science Literacy Goals: The Role of Research

Peter Hewson **Alan Hofmeister** **Susan Matthews** **Edward Smith**

With Project 2061's publication of Benchmarks for Science Literacy and the National Research Council's release of the draft National Science Education Standards, there now exists a strong consensus among educators on K-12 science literacy goals. Within the broad science education community, states and school districts are using these documents and other tools to bring about change in a variety of ways. Whatever their particular focus, they all confront a common challenge: developing a K-12 curriculum requires a greater and more diverse collection of materials than currently exist. What kinds of curriculum materials are available? What is involved in developing more? This session will consider issues that arise in attempting to evaluate materials for their fit to learning goals, describe a research and development process that can in time yield the materials the science education community needs, and consider barriers and alternatives to R&D efforts to develop curriculum materials that address learning goals. Research needed to inform these issues will be identified. The panel of speakers will provide insights from the perspective of researchers involved in curriculum design and evaluation, teacher educators, and curriculum users.

Keys, Carolyn W.

Strand D **Monday, April 1, 1996**
10:30 am — 12:00 pm
Illinois Central

The Power of a Partner: Using Collaborative Discussion to Build Understandings of Constructivism as a Referent for Middle Grades Science and Mathematics Teaching

Priscilla S. Golley

This study reports on teacher collaborative discussion during the implementation of a reflective teaching model. Experienced science and math participants focused on constructivist learning in mentor-mentee pairs. The purposes of the study were to: (1) identify characteristics of effective collaborative discussion and (2) describe how participants have changed their own teaching practices. Semi-structured interviews were conducted with nine participants. Themes that emerged in relation to effective discussion included: the receptivity of the mentee; the non judgmental stance of the mentor; and skillful questioning of the mentor that allowed the mentee to see new perspectives. Three themes emerged in relation to teacher change: teachers actively seek out and value children's math and science ideas; teachers use reflective processes to continuously monitor their own teaching; and teachers use new understandings of hands-on activities. While recently published guide books on mentoring for beginning teachers suggest that mentors should act as assessors, advisors, content experts, and motivators, experienced teachers believe that mentor listening is critical to mentee's construction of knowledge about teaching. Participant teachers view their own changes in terms of broad principles about children's learning, rather than as specific modifications to methods or curriculum.

Khourey-Bowers, Claudia

Strand D **Sunday, March 31, 1996**
7:00 pm — 8:30 pm
Illinois Central

Grassroots Science Teacher-Leader Institute: Change from within

Grassroots Science provides a model for systemic reform, grounded in conceptual change theory and enacted through constructivist principles. This study documents the first of three phases of systemic reform in an urban school district. The overall goal of the program was to enhance science content knowledge, self-efficacy, and constructivist practice within a framework of collaboration. The inservice program, initiated by district teachers, was designed to immerse a corps of teachers into an enhancement program. Others would be reached through dissemination activities. Guided by conceptual change theory, the close-knit nature of the community necessitated a grassroots approach to inservicing. An important design element of the program was to encourage participant involvement, acceptance, and internalization of all aspects of the inservice program. Forty teachers participated, representing all four middle schools and 16 of 18 elementary schools in the district, during a 4-week summer training program. Content experts presented science content and teaching ideas in constructivist style, which district high school teachers augmented with practice-related ideas and skills. Participants wrote personalized lesson plans, manipulated equipment , and initiated networking. Analysis of quantitative results include significant gains in science content knowledge, self-efficacy, and constructivist practice.

Kirk, Maria K.

Strand A **Sunday, March 31, 1996**
8:30 pm — 10:00 pm
Regency A, B, C

A Pre-Lab Guide for General Chemistry: Improving Student Understanding of Chemical Concepts and Processes

John W. Layman **William S. Harwood**

This study investigated perceptions of 56 students, in four general chemistry labs taught by two instructors, regarding their understanding of chemical concepts and processes. Conceptual understanding of scientific investigation was the focus. Students using a pre-lab guide for lab preparation were compared with students completing a traditional pre-lab assignment. Data sources included a student survey and interviews. Results were analyzed by common qualitative methods (Strauss and Corbin, 1990). Forty-one percent of students felt their pre-lab materials were helpful. Sixty-four percent expressed confidence in their ability to learn chemical concepts and processes; sixty-seven percent were confident of their ability to conduct chemical investigations. The experimental groups exhibited no significant differences. A significant instructor effect was found. Sixty-two percent of the students instructed by the researcher felt their approach was helpful; twenty-three percent of the adjunct's students were positive about their pre-lab tasks. Five themes emerged from the written student comments: aspects of the course, lab-related issues, instructors, assessment, and affective responses. Analysis of interviews supported survey findings. Students using the pre-lab guide felt better prepared to conduct experiments and had a clearer understanding of chemical concepts and the scientific process.

Klapper, Michael H.

Strand D **Monday, April 1, 1996**
1:00 pm — 2:30 pm
Grand C

Enhancing the Professional Status of Teachers Through Partnership

Phillip A. Heath

The Science Teaching Partnership Project is designed around the use of small grants to teachers and schools and partnering with university scientists and engineers. Middle school teachers, individually or in teams, formulate and develop a proposal for a 1-2 month science unit to use in their own classes. Teacher progress is monitored through three meetings of all the participants, final oral and written reports, classroom site visits, and interviews. Twenty-three projects were completed. Our conclusions suggest that: i) teachers on their own initiative produce interesting and high quality science and technology units, ii) the development of these units stimulated teacher self-learning of content and teaching methods, iii) there appears to be a heightened level of collaboration of Partnership Project teachers with other teachers within the school and with individuals from outside the school, iv) many participating teachers successfully sought out additional support and cooperation from within their local communities, v) many of the units were interdisciplinary, and vi) the status of participating teachers was often enhanced. We suggest that the outside contribution of content expertise coupled with a minimal financial support can catalyze a burst of innovative activity.

Koba, Susan

Strand A **Monday, April 1, 1996**
1:00 pm — 2:30 pm
Jeffersonian

Integrated Science: Students' Conceptions and Conceptual Change

Kelly Gatewood **Deirdra Rochell** **Ginger Hawhee**

The purpose of this session will be to provide a picture of science learning and teaching at Omaha North High School. A description of the classroom setting which integrates science disciplines and eliminates tracking will be provided. Studies of student perceptions of the Integrated Science course and barriers to teacher change in this program will be included. Action research by teacher participants on diverse assessments and effective teaching strategies in multicultural communities will be discussed. These studies and experiences describe classroom teachers' efforts at multicultural science reform. Participants will share their research and invite the audience to share experiences and question the rationale of the reform effort.

Koballa, Jr., Thomas R.

Strand A
Sunday, March 31, 1996
8:30 pm — 10:00 pm
Regency A, B, C

Teachers' Conceptions of Wasps as Revealed by Their Drawings

Eric J. Pyle

Teachers (n=73) were asked to "draw what you know about wasps and where they live", immediately before, after, and one year after participating in activities involving Melittobia digitata to determine their conceptions of wasps, their level of conceptual change with respect to wasps, and the stability of that change over time. Initial drawings contained combinations of proper and improper anatomy, frequent associations with paper wasps (Polistes spp.) and expressions of fear, flight, and pain. After participating in the activities, considerable shifts were observed in both character and substance of the drawings. The drawings revealed clear gender identification clues, the realization that not all wasps are macroscopic, and more positive feelings toward wasps. After one year, drawings produced by the teachers were nearly indistinguishable from those produced after participating in the activities.

Komorek, Michael

Strand A
Tuesday, April 2, 1996
8:30 am — 10:00 am
Grand B

Conceptual Change on Conceptual Growth: Students' Pathways Towards Understanding Limited Predictability of Chaotic Systems

The learning process study presented in this paper is part of a larger project on "educational reconstruction" of elementary features of chaos theory. The aim of this project was to detect the elementary, qualitative ideas that comprise recent theories of deterministic chaos and fractal structures on the one hand, and to analyse their educational potential on the other hand. Les Steffe's experimental teaching method was employed in order to investigate students' pathways from certain everyday ideas towards the science view of limited predictability of chaotic systems. This method allowed combining features of interviews and model instruction. Eleven grade 12 students were interviewed in four tutorial sessions. The last session took place about two month after the third session in order to detect long term effects. The learning processes revealed show in which way students changed, developed and refined initial common sense views. All these processes may be seen as conceptual growth. No conceptual change processes with major reconstruction of the already existing conceptions were necessary to understand limited predictability.

Kurth, Lori A.

Strand B
Monday, April 1, 1996
4:00 pm — 5:30 pm
Burlington Route

Conflict and Consensus in Elementary Children's Small Group Problem Solving

Edward L. Smith

This study is part of a multi-year all-school project integrating science and literacy. The study involves analysis of video taped small group problem solving activities. Sixteen fifth grade children worked in groups of four on one of two problems as a pre-instructional assessment and on the other as a post assessment. Methods of analysis were developed for examining the children's means of achieving consensus and characterizing the role of disagreements and conflicts in the consensus process. Students often used methods to achieve consensus that were far different from the equitable goals of cooperative learning. Consensus achieved quickly through a distillation of common elements from individual answers or using the "best" individual answer was superficial in discussion of content. Disagreements were present in these discussions but were not explicitly acknowledged by the group participants. Groups that engaged in substantive discussion of scientific content expressed explicit disagreements that were either scientifically based and contributed to conceptually stronger consensus or that were socially based and hindered or prevented consensus. By understanding the nature of children's interactions in groups, teachers may be able to provide more constructive contexts for students to develop social behaviors and engage in meaningful learning.

Labudde, Peter

Strand F **Wednesday, April 3, 1996**
10:30 am — 12:00 pm
Grand A

Physics for Girls and Boys: Teaching and Learning Strategies Examined in 25 Classes at Upper Secondary Level

Walter Herzog **Charlotte Gerber** **Enrico Violi**

In this experimental study various strategies are developed and empirically tested for a physics instruction that should improve girls' and boys' attitudes toward and achievements in physics. Strategies include opportunities to integrate different pre- existing knowledge, variation of teaching methods to enhance cooperation and communication in the classroom, supervision of teachers.- The research design includes three experimental groups I-III and a control group: the teachers of experimental group I together develop a set of teaching and learning materials (40 lessons optics and kinematics), use it in their physics courses, and get a supervision. Group II uses the same set of materials, and gets the same supervision. Group III uses the set of materials, too, but gets no further support.- Data sources are various student and teacher questionnaires, classroom observations, and semi-structured interviews with teachers. First results of the intervention (in 25 classes from Aug. 1995 to Jan. 1996) will be presented. Implications for the teaching and learning of physics, and for teacher education will be discussed.

Landis, Carol

Strand C **Monday, April 1, 1996**
1:00 pm — 2:30 pm
Burlington Route

Teacher Thinking about Issues-Use: Implications for Reform?

Science literacy is a primary component of current science education reform efforts. Secondary science teachers who believe that their intended and implemented curricula address science literacy were sought for participation in research. The study was designed to ascertain and describe teachers' concerns about issues-based instruction, and their levels of anxiety in relation to use of specific issues. Sixteen secondary science teachers participated in the study, contributing to both qualitative and quantitative inquiry of the topic, and the development of a model. They submitted autobiographical information, reflections on issues-based instruction (both as a learner and as a teacher), and self-reports about their primary concerns related to issues-use. In addition, the teachers provided two self-reports of their levels of anxiety about each of three hypothetical teaching scenarios, which were analyzed for individual and group means. The participating teachers expressed concern for their accountability regarding student achievement in content knowledge and mathematical skills when developing lessons. The findings also suggest that consideration of specific issues may increase teacher anxiety. Teacher education programs and science teachers need to collaborate in the consideration of the perceived disjuncture between goals and assessment.

Lang, Manfred

Strand D **Tuesday, April 2, 1996**
10:30 am — 12:00 pm
Regency B

PING — A Collaborative Study in Integrated Science Education

PING (Practising Integration in Science Education) is a program for development and evaluation of integrated science education in lower secondary schools in Germany. It was established in 1989 as a regional school project in one federal state and spread continuously. 1993 the project was acknowledged and financed as a national pilot project by the federal government, 1995 it became part of the OECD- project SMTE (Science, Mathematics and Technology Education) for comparative national evaluation about the development of science, mathematics and technology education in different countries. The central question in the German case-study is about the function and effects of collaboration in the PING-project. Teachers from pilot schools, inservice teacher training institutes and researchers at the IPN cooperate by direct exchange in workshops, meetings, by mail or in an electronic network. The results and conclusions from interviews, questionnaires, documents and lesson-materials in the PING-project are portrayed in a model of collaboration and reflective practice. Evaluation confirms the importance of institutionalization and the dominant influence of direct collaboration for reflective practice in teacher training and research meetings and the supplementary function of network communication.

Larson, Jane O. **Strand F** **Monday, April 1, 1996**
4:00 pm — 5:30 pm
Grand A

"I'm Just Not Interested": Gender-Related Responses in a High School Chemistry Program

Within the context of a high school chemistry curriculum implementation, gender-related issues became apparent. This study documents observed differences in male and female responses to shared experiences in the course, and analyzes these reactions in light of research on gender in science education. Major areas of distinction in student reactions were noted in (a) work habits, (b) classroom demeanor, (c) response to chemistry activities such as labs and tests, (d) attributions for success, (e) attitudes toward chemistry, (f) attitudes toward science, (g) decisions to remain in the science 'pipeline'. Female students' loss of confidence and interest led to negative attitudes manifested in decisions to exit the science track. Although the chemistry teacher attempted to maintain a positive learning environment, he apparently failed to meet the needs of his female students through gender-blind practices. Research literature that addresses these phenomena attempts to root them in cultural expectations and attitudes perpetuated in curricular materials, classroom interactions, and instruction. The complex network of determining factors in the chemistry class is investigated, and suggestions for alleviating the loss of females from science education are discussed.

LaRussa, Annette **Strand D** **Tuesday, April 2, 1996**
10:30 am — 12:00 pm
Grand C

Factors in Preservice Teachers' Acceptance of Science Education as a Valid Source of Knowledge for Teaching

This paper describes, in part, the findings of a year long study of a preservice science teacher education program. The purpose of the study was to contribute to a developing understanding of the process of learning to teach through preservice teacher education. The design and methodology reflected a constructivist understanding of knowledge development. As such the qualitative data collection techniques (including observation and interviewing) gave priority to what the prospective teachers considered to be of most importance throughout the year. A hypothetical model was developed, based on the interpretation of the data, suggesting that prospective teachers go through a progression through which they decide whether to accept or reject the teacher education program as a valid source of knowledge for teaching. If they reject the program, their prior beliefs resolidify. If they accept the program, a new belief system is constructed drawing on both information from the teacher education program and on their prior beliefs about good science teaching. Story-based cognition plays a role in both maintaining existing beliefs and in developing new beliefs.

Latz, Mark S. **Strand D** **Tuesday, April 2, 1996**
10:30 am — 12:00 pm
New York Central

Managing Subject Matter: Does it Really Matter?

Norman G. Lederman

The purpose of this study was to identify the management demands unique to science classrooms. Two quantitative questions were addressed: 1) What is the frequency of contexts utilized in the two content areas and 2) what is the average amount of time spent in each of the contexts based on the content being presented? In addition, a qualitative research question was addressed: Are there specific management patterns to be emphasized based on the context and subject matter being presented? The results show that seatwork, group seatwork, and student presentations occurred more frequently in language arts classes. In contrast, hands-on activities, non-academic activity, and dead time occurred more frequently in biology classes. In addition, language arts classes spent significantly longer time in individual seatwork activities; while in biology classes, longer time was spent in lecture, tests, and transitions. Qualitative analysis indicates that the classroom management behaviors of teachers were quite consistent. In general, subject matter differences do not reveal themselves directly in terms of management. What seems more important are the instructional approaches taken within the two subject matter areas. The instructional approach, in turn, dictates the types of contexts which then determines the management demands.

Lavoie, Derrick R.

Strand A **Wednesday, April 3, 1996**
10:30 am — 12:00 pm
Grand C

The Effects of Combining Concept Mapping and Reflective Writing on Post-Secondary Students' Science Attitudes and Conceptual Understandings of Biology

The purpose of this study was to determine the effects of teaching a post-secondary biology content course to elementary science majors using a concept mapping strategy that emphasized reflective writing. Changes in content understanding and scientific attitudes were assessed between and within a treatment and control group. The treatment group received the concept mapping strategy followed by reflective writing and the control group received only the concept mapping. Factors affecting concept map construction and the reflective process were identified. An initial pretest established equivalency of the treatment and control group. Results showed significantly higher scores of the treatment group over the control group relative to conceptual understanding, concept map scores, and attitude toward learning science. The student concept maps became useful for identifying alternative scientific conceptions and learning problems.

Lee, Okhee

Strand F **Monday, April 1, 1996**
8:30 am — 10:00 am
Grand A

Interactional Patterns of Linguistically Diverse Students in Science Performance

Sandra H. Fradd

Research on teacher-student interactions suggests that congruent interactions promote student engagement. Building on current research, this study proposes a new term, instructional congruence, to integrate the process of developing cultural congruence with the process of communicating academic content, such as science. Specifically, this study focused on the nature of science discourse as students and teachers of the same language and gender communicated during three science tasks. To better understand interactional patterns of diverse language groups, the study included triads of students and teachers from three different languages. Qualitative and quantitative data analyses focused on patterns of discourse, including both verbal and non-verbal communication, and task engagement patterns. The findings indicate consistent interactional patterns within each group, but distinct differences among the three language groups. The findings suggest ways to enhance science instruction and to extend the knowledge base needed to promote science learning opportunities for linguistically diverse students.

Lennon, Patrick Alan

Strand C **Tuesday, April 2, 1996**
2:30 pm — 3:30 pm
Regency C

Student, Graduate, and Faculty Perspectives on Fledgling Content-Based Doctoral Programs in Science and Mathematics Education

Sharyn Rusk **Jim Holden** **Steven Pulos**

Biology, chemistry, and mathematics departments at a leading Rocky Mountain teachers university developed programs leading to the Doctor of Philosophy degree in content-based pedagogy, in response to demands for a professoriate that is better trained to teach. These were studied in attempt to determine the effectiveness of the programs and to provide insight for others attempting to design similar programs. 14 doctoral candidates/graduates and 6 faculty were interviewed or surveyed, and program catalogs, missions statements and/or program review summaries were examined for triangulation. Trends in the data generated included the following: 1) most students entered the program because they hoped to obtain primarily teaching positions in smaller colleges and universities; 2) students and faculty both concluded that there was an overload of coursework in attempt to broadly educated students in both content and education; 3) while the programs emphasized broad content knowledge and teaching, there was a striking lack of preparation of students to research teaching/learning in the content areas; and 4) many of the graduates had obtained primarily teaching positions in content area departments, teaching content courses and including methods courses for pre-service teachers.

Leonard, Mary Alice **Strand D** **Tuesday, April 2, 1996**
8:30 am — 10:00 am
Grand C

The Impact of Peer Conflict on Implementing Instructional Change

Susan L. Westbrook

The purpose of this investigation was to examine the extent peer conflict and interference impacted implementation of instructional reform by two teachers in a small, rural high school. The method of naturalistic inquiry was employed; the researchers assumed the role of participant observers. Data sources included formal interviews with school administrators and faculty, informal discussions with faculty and students, classroom observations, telephone conversations, and teacher journals. The active interference by two of the school's lead teachers was motivated by (a) protection of professional status, (b) parental concerns, and (c) maintenance of personal teaching methods and school culture. Attempts were made to persuade, and later to force, the participating teachers to change back to their original methods of teaching. Tactics in the conflict included (a) negative communications with parents and administrators, (b) direct confrontations, and (c) questioning the credibility of the researchers and the instructional method. Successful avoidance of the possible consequences associated with the peer interference was attributed to the support the teachers received from each other, the university research team, and the school administration.

Lewis, Scott P. **Strand J** **Sunday, March 31, 1996**
7:00 pm — 8:30 pm
Burlington Route

A Study of a Science Apprenticeship Program in a Museum Setting

Esther Oey

This study examines a museum science apprenticeship program for urban high school students who worked on year long research projects in a natural history museum. While apprenticeship learning is of great interest to educational researchers who see promise in its teaching, problem situated contexts, and motivational aspects, it has not been adequately studied in science education research. In the program observed, nineteen predominantly minority students met on Saturdays from October 1993 through May 1994 in one of four research groups (brittlestars, horned lizards, polychaetes, and marine birds). Naturalistic observations methods (using field notes and audiotapes) were employed to record the activities as students worked on their projects and interacted with each other and curators. Categories of learning in the museum apprenticeship will be created based on patterns observed. These will be discussed using a framework that takes into account current research on apprenticeships including issues of identity, access, and the impact of culture on cognition. In addition, we will compare learning in the museum context with learning in the school context. This has implications for analyzing science apprenticeship programs as well as science learning in the classroom.

Liang, Ling L. **Strand A** **Tuesday, April 2, 1996**
10:30 am — 12:00 pm
Grand B

Making a Difference in Science Learning: How the New Constructivist Curriculum Can Build a Brighter Future for Tomorrow's Students

The purpose of this study was to examine the effectiveness of a new PSI-PET science curriculum model (Powerful Ideas in Physical Science, PIPS) for elementary education majors, by comparing classes taught using the new curriculum with classes taught utilizing a more traditional hands-on approach. Both qualitative data (interviews, videotapes) and quantitative data (achievement test, attitude survey) were analyzed for significant changes in students' learning outcomes in cognitive and affective domains, as well as to gain a better understanding of the process of students' conceptual changes. The results of this study should help develop more effective science curriculum and instructional strategies.

Lin, Shu Hua

Strand D

Tuesday, April 2, 1996
4:00 pm — 5:00 pm
Regency C

The Development of Preservice Teachers through Media-Based Task: A Case Study of Teacher Training Program in Taiwan

From this point of view, as teachers develop, teachers are learners too, who construct teaching through years of practice. Strategies in research reports were adapted in teacher education courses to make progress. As an instructor of a biology methods course, concerned with the development of preservice teachers within the course, the purpose of this study was to see if preservice teachers reconstruct their teaching through course designes tasks. The course was designed to be media-based and task-oriented. Twenty- four students were required to implement a biology course, a teaching task, which included subject matter portfolio, instructional media, teaching plan and an assimilatory practice. Documents, videotapes and field notes were collected for qualitative analysis. In addition, four students were either formally or informally interviewed to focus on the research question. The researcher constructed findings through data analysis which showed three stages of development: osmosis, diffusion, and immersion.

Lin, Weir-Sen

Strand C

Monday, April 1, 1996
10:30 am — 12:00 pm
Missouri Pacific

The Examination and Prediction of Science Teachers' Intentions to Teach about HIV/AIDS

John T. Wilson

A self-administrated questionnaire was conducted to examine and predict science teachers' intentions to teach about HIV/AIDS. Two hundred and seventy-eight science teachers from different sized school districts across the state of Iowa participated in this study. Results of this study indicate that four variables of reasoned action and planned behavior theories, attitude toward teaching about HIV/AIDS, perceived behavior control, belief-based perceived behavior control, and belief-based subjective norms, were identified as best predictors to explain 76% of the variances in science teachers' intentions. Attitude toward teaching about HIV/AIDS was the most significantly important factor in the prediction. Variables representing science teachers who taught biology, grade 7 and 12, and had past experiences of teaching about HIV/AIDS also made significant contributions to the prediction of teachers' intentions. Most Iowa science teachers intended to teach about HIV/AIDS. Analysis of variance found significant differences between different intention groups. Respondents who intend to teach about HIV/AIDS had more positive attitudes toward teaching about HIV/AIDS, less negative social influences mostly from principals, school board members, and parents, as well as adequate resources and material to control over teaching about HIV/AIDS. These factors which influence teaching about HIV/AIDS should be recognized to encourage science teachers' participation. The relationship between intentions to teach about HIV/AIDS and actual teaching behaviors is suggested to be studied in a future study.

Lindauer, Ivo

Strand D

Tuesday, April 2, 1996
2:30 pm — 3:30 pm
Wabash Cannonball

7th and 8th Grade Science Teachers: A Profile

Mary Queitzsch

Science teachers in junior high schools are required to teach a variety of subjects crossing several disciplines. In many schools, the high school science teacher may teach one or more courses in the junior high school which is especially true in rural areas or schools having a low enrollment. From the Schools and Staffing Survey (SASS), 59,692 teachers identified science as their main teaching assignment and taught at least one science class in the 7th and 8th grades. The results from this study were divided into five sections. The first section presents a review of the demographic distributions for the sample. The second section covers the actual teaching assignments. The third section provides a view of preservice science preparation. The fourth science looks at professional development, workshops and inservice. The last section gives the teachers' point of view as to what field they feel best qualified to teach. Items selected from the SASS survey and reported in this study provide a generalized profile of science preparation for the teachers' assigned duties.

Liu, Chin-Tang

Strand E

Tuesday, April 2, 1996
8:30 am — 10:00 am
Regency A

The Iowa SS&C Project: Progress and Promises of a National Science Education Reform Initiative

Robert E. Yager	**Judith Burry-Stock**	**Gary Varrella**	**Chin-Tang Liu**
Mark Trax	**Robyn Freeman**	**Sandy Enger**	**JoAnn Lewis**

The Iowa-Scope, Sequence, and Coordination (SS&C) project is a part of the national reform effort conceived by the National Science Teachers Association (NSTA) which operated during 1990-94 in California, North Carolina, Puerto Rico, and Texas as well as Iowa. The Iowa-SS&C operated in ten Iowa school districts where the basic tenets were targeted using the Science-Technology-Society approach and Constructivist teaching practices. Iowa-SS&C has resulted in new frameworks for the districts involved for grades 6-8, new assessment programs, strategies for accomplishing teacher changes, and multiple evidences of improved student learning. From 1994-97 the effort has been extended to grades 9 and 10 along with more than a dozen satellite centers in Iowa as well as "shadow" efforts in other states. The major outcome of Iowa-SS&C is achieving more and better student learning in six domains when compared with similar students who have not experienced SS&C science. The six learning domains include: 1) The Concept Domain (mastering basic content constructs); 2) The Process Domain (learning skills scientists use as they seek answers to their questions about the natural world); 3) The Application Domain (using concepts and processes in new situations); 4) The Creativity Domain (improving quantity and quality of questions, explanations, and tests for the validity of personally generated explanations); 5) The Attitude Domain (developing more positive feelings concerning the usefulness of science, science study, science teachers, and science careers); and 6) The World View Domain (how the efforts assist students to understand the nature of science and to practice the basic ingredients, namely: questioning, explaining, and testing objects and events in the natural world).

Lohrke, Charles T.

Strand A

Monday, April 1, 1996
2:45 pm — 3:45 pm
Regency A

The Use of Analogies in an Industrial Environment to Facilitate Status Changes for Radiation Science Concepts

Robert Poel

The purpose of this study was to determine the effect of two analogies (melting ice and falling tacks) on the statuses of forty-four industrial technical center employees for three radiation science concept areas; decay, half-life, and activity. Forty-four participants took pre- and post-lesson multiple-choice tests to determine the effect that the analogies had on their intelligibilities of the three concept areas. Nine of these participants also took pre- and post-lesson clinical interviews designed to assess the intelligibility, plausibility, and fruitfulness for the concept areas. These interviews were interpreted utilizing subcategories of status in large part derived from the works of Thorley. Results indicated that the use of the analogies resulted in increased statuses in all three concept areas. In addition, learning steps for one of the decay concepts were identified and associated with ancillary knowledge. The statuses that the learners held for this concept fluctuated as they progressed through the learning steps.

Lord, Thomas R.

Strand B

Tuesday, April 2, 1996
4:00 pm — 5:00 pm
Illinois Central

A Look at Visual-Spatial Perception in Preservice Secondary Education Majors

Two standard measures of spatial aptitude (cube rotation and paper folding) were given to several hundred students majoring in various disciplines in secondary education at a midsize university. The population averaged 21 years of age and contained as many male as female members. The results of the tests were scrutinized by subject-matter concentration and sex, and compared to national averages for the activities. The results indicate that preservice secondary school teachers that chose to specialize in spatially-challenging disciplines are themselves very high in visual-spatial aptitude while preservice teachers that were not good in spatial perception do not choose to major in those subjects. Furthermore, the study found that women who chose to teach in the high spatial requiring disciplines were as good in spatial ability as the men who teach in them.

Loving, Cathleen C.

Strand H **Monday, April 1, 1996**
10:30 am — 12:00 pm
New York Central

Reaching Consensus on the Nature of Science: Implications for the Classroom

Norman G. Lederman **William W. Cobern** **Catherine L. Cummins** **Sherry S. Demastes**
John Trowbridge **Ronald G. Good** **Michael R. Matthews** **Yvonne J. Meichtry**
James H. Wandersee

Participants will address a variety of relationships and paradoxes between views on the nature of science and resulting classroom practice. Topics include: science/technology, experimental methods/alternative methods, "safe" science/confrontational science, philosophy of science/science content, beliefs/worldviews/science content, multicultural approaches/"Science For All Americans," history & philosophy of science knowledge/ease in reaching consensus, and chosen science curriculum/nature of science stance. Participants hope to provide NARST members with shortened versions of papers on NARST LISTSERV before the conference, beginning March 1, 1996. Jigsaw discussion groups will be formed during the session, and complete papers will be available.

Lucas, Keith B.

Strand H **Monday, April 1, 1996**
2:45 pm — 3:45 pm
New York Central

The Nature of Science as Viewed by Students and their Teacher and as Enacted in Curriculum

Campbell J. McRobbie

The objective of the study was to explore the fit between teacher and student beliefs about the nature of science and the nature of science enacted in the curriculum. The participants were an experienced grade 11-12 physics teacher and his class of 24 students in a government high school in Brisbane, Australia. Data were derived over a period of six weeks from field notes, interviews, videotaped lesson segments, and questionnaires on the views of students and teacher about the nature of science and the classroom learning environment. In many ways the views of the teacher and most of the students about the nature of science were consistent with recent findings in science studies that represent science as tentative and evolving. Contrasting with this, the enacted curriculum presented science as a system of universal and timeless truths. The learning environment questionnaire and interviews showed that students were accepting of the learning environment being experienced and saw no tension between the views of science being enacted in the curriculum and their own views of the nature of science. The paper discusses implications of the inconsistency of fit between participants' views of the nature of science and the nature of science enacted in the curriculum.

Lumpe, Andrew T.

Strand C **Monday, April 1, 1996**
10:30 am — 12:00 pm
Missouri Pacific

Teachers' Beliefs and Their Intent to Implement Science/Technology/Society (STS) in the Classroom

Jodi J. Haney **Charlene M. Czerniak**

Science/technology/society (STS) is a common thread throughout recent science education reform recommendations. Based on the importance of teacher beliefs in the successful implementation of reform recommendations, the researchers sought answers to two primary questions: 1) what are science teachers' belief-based affects concerning the implementation of STS in the classroom? and 2) how do teachers' belief-based affects relate to their intent to implement STS in their own classrooms? The Theory of Planned Behavior was used to determine K-12 teachers' attitudes toward implementing STS, subjective norm (what others think about STS), and perceived behavioral control (external influences to teaching STS). In a multiple regression model, all three constructs, attitude toward the behavior, perceived behavioral control, and subjective norm, accounted for a large portion of the variance in teachers' intent to implement STS in their classrooms. It was concluded that if STS is to be included in school reform, these three teacher belief constructs should be carefully considered when planning teacher development.

Lynch, Sharon

Strand F

Monday, April 1, 1996
1:00 pm — 2:30 pm
Grand A

An Equity Blueprint for Project 2061 Science Education Reform

Mary Atwater Okhee Lee Jo Ellen Roseman Sharon Lynch

The Equity Blueprint is the latest of twelve Blueprints commissioned by AAAS Project 2061 to discuss how aspects of the system affect attempts to implement Project 2061, and how Project 2061 may affect the system. In a science reform effort that launches its philosophy in a book called Science for All Americans, the importance of equity can hardly be overstated, particularity in an educational system that has primarily viewed science as the preview of the upper 10-20%. The Equity Blueprint systematically examines the current state of equity in U.S. science classrooms, and projects what Project 2061 might do in order to advance the reform in a fashion that does not further stratify opportunity to learn science, but rather opens science to all in order to advance science literacy. Since this is a work in progress, guided by the best thinking of science educators and researchers, the purpose of this symposium is to discuss the Equity Blueprint, to get useful analysis and feedback on the document, and to better understand areas for further research in equity issues and science education reform.

Marlow, Michael

Strand D

Monday, April 1, 1996
8:30 am — 10:00 am
Grand C

Impacts of a Constructivistic-Inquiry Approach to Extended Classroom Activities on Secondary Level Science Teachers' Attitudes About Inquiry-Based Science

The purpose of this study is to examine the impact of extended classroom activities, designed from a constructivistic inquiry viewpoint, on the changing attitudes of a group of secondary teachers towards inquiry-based science. The class consisted of a series of exploratory outdoor activities, where the teachers participate in a series of connected investigations supported by the course instructors' modeling of scientific inquiry. thirty-two teachers, enrolled in two sections of the science education course, participated in the study. Data were collected from curriculum documents designed by the teachers, written material produced during the course by the teachers, field notes from observation, and interviews with the teachers. Two questions guided the investigation: 1) What were the teacher's views of science and how students acquire knowledge in a classroom; 2) Did the experience of participating in actual scientific inquiry in an extended classroom setting motivate the teachers to do more inquiry-based science within their classrooms? Results indicated significant change in attitudes toward inquiry-based science.

Martinello, Marian L.

Strand A

Tuesday, April 2, 1996
2:30 pm — 3:30 pm
Grand B

Changes in Children's Questioning During Guided Co-Inquiry with Mentors

Linda M. Boothby Elsa Duarte-Noboa Diane Moses

The main question of this study was: How do fourth grade children's questions change as they actively co-inquire into a topic of personal interest for which they have limited background? Two Hispanic girls, one Hispanic boy, and one Anglo girl self-selected animals to investigate with individual mentor-teachers during nine 1-1/2 hour inquiry sessions. The mentors served as participant-observers and supplied varied resources to encourage the children's questioning about their topic of interest. The children kept inquiry notebooks, as did their mentors and the principal researcher. These were analyzed for evidence of children's questioning patterns over the time of the inquiry. All four children began their explorations with concrete fact-seeking questions. Using different intervention strategies, the mentors guided the children's question formulation, using question stems to encourage higher order questioning. The individual children's questioning changed in idiosyncratic ways but all demonstrated more complex information procession. None developed questioning sequences for focused and sustained inquiry. The mentors became aware of their own questioning tendencies, the need to actively develop children's higher order questioning, and of ways of guiding children to formulate lines of questioning for inquiry of increasing depth and breadth.

Mason, Diana

Strand E **Tuesday, April 2, 1996**
10:30 am — 12:00 pm
Grand A

Life After ChemCom: Do They Succeed in University-Level Chemistry Courses?

Chemistry in the Community (ChemCom) is a high-school level chemistry text developed by the American Chemical Society (ACS) designed for the college-bound student. Funds for its development have been contributed by the National Science Foundation (NSF), ACS, and Kendall/Hunt Publishing Company, but have the efforts of this large collaborative endeavor paid off? The purpose of this study was to identify students enrolled in a university-level chemistry course designed for the nonscience major who had experienced the ChemCom curriculum in high school and to evaluate their success. Participants (n = 685) from two summer courses (1993 and 1995) were classified into six groups: no prior chemistry, first-year ChemCom, first-year regular, first-year honors, second-year (Chem II), and advanced placement (AP) students. Final course averages for each group were calculated and compared. All groups of students on the average were successful in completion of the course (i.e., had averages above 66%). Results of a t-test indicated statistically significant differences occurred at an alpha level of .05, but the ChemCom group did not exhibit a statistically significant difference. Other findings included a decline in enrollment over the experimental period, especially for the ChemCom group.

Matkins, Juanita Jo

Strand C **Monday, April 1, 1996**
1:00 pm — 2:30 pm
Grand B

Customizing the Draw-A-Scientist Test to Analyze the Effect That Teachers Have on Their Students' Perceptions of and Attitudes Toward Science

J. Preston Prather

This study examined the effect of instruction of teachers trained in an Integrated Physical Science for Elementary Teachers (IPSET) program on students' attitudes toward and perceptions of science and scientists. Other factors examined were the effect of gender and grade level on perceptions. A revised version of the Chambers Draw-a-Scientist Test was used. The IPSET teachers were involved as researchers in revising and validating the instrument. Five teachers developed scoring criteria, directions for administration, and a rubric for the instrument. The test was administered to approximately 850 children from IPSET teachers' classes (TEST) and classes taught by non-IPSET teachers (CONTROL). Pre and posttest scores were analyzed for significant change, using a three-way ANOVA. A t-test was used to compare TEST and CONTROL. Significant change in attitudes and perceptions over a school year were observed among TEST students, and there were significant gender differences. Lack of significant results in CONTROL classes indicated that the IPSET teachers had a greater influence upon students' perceptions than is attributable to maturation. A significant effect of grade level range was observed, with K-1 children having poorly developed concepts of science.

Matthews, Michael R.

Strand H **Tuesday, April 2, 1996**
4:00 pm — 5:00 pm
New York Central

Lessons from the Past: Philosophy of Science and US Science Teaching in the 1960's — The Work of James T. Robinson

This paper examines J.T. Robinson's writings of the 1960s, in particular his 1968 book The Nature of Science and Science Teaching ñ which is arguably the first English-language book devoted to the relationship between philosophy of science and science teaching. The claim is made that the present revival of interest in epistemological matters in the science education community can only benefit from examining past efforts to bring the two fields into productive contact. It is shown that Robinson's writing is heavily, and unhealthily, influenced by the then dominant logical empiricist, verging on positivist, tradition in philosophy of science, especially the work of Henry Margenau. Some problems with this positivist tradition are pointed out, and the more general question is raised of how science educators, whose professional competence is not philosophy, can promote philosophy of science without necessarily embracing any particular philosophical school.

Mattson, Sue

Strand D **Wednesday, April 3, 1996**
10:30 am — 12:00 pm
Grand B

Images of Change in Science Teaching and Learning: Exploring the Power of Video Case Studies in Teacher Education

Terez Waldoch **Pat Coleman** **Sherry Nichols** **Tony Lorsbach**
Nancy Davis

Case study methods are a tradition in numerous fields--including business, law, and medicine--where there is a relative abundance of case collections and academic literature. The use of case studies in teacher preparation, however, is only beginning to be represented in academic research. And, although the use of video case studies is increasing, there are few published accounts of research conducted on their use in teacher education. The Video Case Studies Project in Science Education is creating 25 half-hour videotapes focusing on issues in science teaching and learning. The primary goal of this project is to create visual models of reform in science education that will provoke learners to reflect upon, test, and perhaps modify their ideas about classroom practice. The goals for this symposium are: 1) to introduce video case study methods as a viable approach to teacher education in science; and 2) to present and discuss findings associated with preliminary field testing of Project videotapes. We hope to provide a forum to discuss the potential for using video case studies in various settings for teacher education. In addition, we hope to explore the potential for research to be done in conjunction with their use.

McClurg, Patricia A.

Strand D **Monday, April 1, 1996**
8:30 am — 10:00 am
Illinois Central

Results of a Longitudinal Study of an Experimental Teacher Education Program in Elementary Science

Joseph Stepans **Ronald Beiswenger**

The purpose of this NSF-funded project was to design a program for pre-service elementary education majors which would result in graduates who were confident, knowledgeable and excited about teaching science. Program components included three innovative content courses with concurrent science education seminars and experiences in mentor teacher classrooms, a methods course with extensive practicum experience and student teaching with specifically trained mentor teachers. Formative and summative evaluation measures were administered to two cohorts (n=66) participating in the five semester sequence. Independent t-tests comparing pre-test and post-test scores on three content examinations, an attitudes toward science and scientists measure, and a level of confidence toward the teaching of science measure revealed statistically significant gains. ($p<.001$). Personal interviews and written anonymous evaluations were used to guide revision. Follow-up telephone interviews of graduates and their administrators indicate that graduates generally outperform peers, exhibit confidence and enthusiasm toward science teaching and teach science more often than reported national averages. Successful results of this program resulted in its institutionalization. Issues relating to maintaining the quality of the program include communication among scientists, science educators and mentors, articulation with community colleges and inculcation of new faculty.

McConney, Amanda Woods

Strand B **Tuesday, April 2, 1996**
2:30 pm — 3:30 pm
Burlington Route

Implications of Vygotskian Thought for Science Educators: A "Novel" Approach

Laura Barden

Vygotsky's work is among the most influential in the current and ongoing development of theories of learning. In this novel format session the implications of Vygotsky's ideas for the science education community will be discussed both in terms of research and teacher education. During the 1995/1996 academic year, a reading group was established on the Internet to discuss the question: What do Vygotsky's ideas have to say to the science educator/teacher? The readings selected by the group were determined by the group through the dynamic and active discussion on the Internet. This session is designed as the year's culminating activity for the group. The yearlong activities were designed to encourage professional collaboration among NARST members, especially tenure track faculty through enhancing communication, identifying common interests, and discussing research developments and their applications in the science classroom. Participants in this session should be prepared to discuss implications of Vygotsky's work regardless of their participation in the reading group. In addition to the discussion of Vygotsky's work, some of the benefits and problems with the development of an electronic reading group will be discussed.

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McConney, Amanda Woods

Strand A

Tuesday, April 2, 1996
8:30 am — 10:00 am
Wabash Cannonball

Intended and Unintended Changes in Postsecondary Students' Decision-Making Orientation and Higher-Order Cognitive Skill Profiles

Uri Zoller **Andrew McConney**

This study investigated changes in the profiles of undergraduate students' decision-making oriented higher-order cognitive skill (HOCS). Decision-making and HOCS are of primary importance in recent and ongoing reform efforts that call for an emphasis on conceptual understanding in science education. The study examined profile changes in the context of science-technology-environment-society (STES) issues for Israeli and U.S. students in both interdisciplinary environmental studies and "traditional" chemistry courses. The study's results indicate substantive changes in students' profiles across the two sites. It was noteworthy that the pre- to post-profile changes for Israeli students experiencing a chemistry course overtly focused on HOCS, were similar to those for U.S. interdisciplinary environmental studies students. However, both of these groups of students exhibited different profile changes as compared to a U.S. group experiencing a more traditional chemistry course not overtly concerned with developing students' HOCS. These findings are discussed in the context of the transferability of HOCS within and across disciplines, an important consideration for the design and evaluation of courses and programs aiming to facilitate the development of these skills.

McCormack, Alan J.

Strand B

Tuesday, April 2, 1996
4:00 pm — 5:00 pm
Illinois Central

VISTA: Infusing Visual/Spatial Thinking into K-8 Science Programs

Cheryl L. Mason

Visual/Spatial Thinking (VST) involves purposeful use of the mind's eye to develop mental pictures or images. VISTA (Visual Spatial Thinking Activities) is a 3-year research/curriculum development project designed to enhance VST in K-8 students. In order to ascertain the effect of having students perform tasks that require visual spatial thinking skills, qualitative and quantitative data were collected. In addition to the baseline data collected during the first year (N=2375), pre- and post- tests were administered during the second year to experimental and control subjects (N=1350). During this time, school visits were conducted to observe classroom environments, science instruction and student behavior, and to interview teachers and students. Overall, statistical and naturalistic analyses of the results of the battery of tests and structured observational measures revealed positive attitudinal changes in students and an enhancement of teachers' abilities both to develop and implement spatially-oriented science and non-science activities. It appears that focused classroom attempts to improve VST, through specially-tailored science activities blended into their classroom science programs, does result in improved visual spatial thinking of students in grades K-8. Subsequent phases of Project VISTA will involve formalization and publication of the products developed.

McDonald, Robert B.

Strand D

Tuesday, April 2, 1996
2:30 pm — 3:30 pm
Jeffersonian

Using Participation in Public School "Family Science Night" as a Component in The Preparation of Pre-Service Elementary Teachers

The purpose of this investigation was to explore the use of public school/university collaborative "Family Science Night" programs as a component in the preparation of pre-service elementary teachers. Collaboratives were established between universities and public elementary schools in southern California and central Texas. Each family night session was facilitated by a science educator from the participating university who was assisted by university students from the school's teacher preparation program. The university students were placed in cooperative groups with elementary students and their parents during hands-on activities. Data were collected using direct observation, parent/child exit surveys, university students' journals, and formal and informal interviews. Data were analyzed qualitatively in order to determine the effects of participation in the sessions on the various individuals involved. The programs in both states were rated as exceptional by the parents and elementary students. The university students at both sites reported learning about science concepts and science teaching strategies, as well as general pedagogical and psychological concepts. The pre-service educators also indicated that the sessions had provided them with invaluable opportunities to interact with parents, and to learn about families.

McFadden, Charles

Strand E **Monday, April 1, 1996**
4:00 pm — 5:30 pm
Regency A

Generalizing Some of the Current Reform Projects in Science Education Into An Action Research and Development Model for Educational Scholarship

Cheryl Mason **Robert Yager**

In response to recent criticism of science education research for its lack of correspondence to the classroom-based projects that are currently reforming science curriculum and instruction, leaders from three of these reform efforts generalize their experience into an action research and development model for science education scholarship. Common features of the California Scope, Sequence and Coordination Project, the Iowa Chautauqua Program and the Atlantic Science Curriculum Project include practitioner identification of the problems to be addressed, the formulation and testing of problem-solving proposals and the sharing of results with other practitioners. In this model of educational scholarship, practitioner initiative and leadership are present; the assistance of experienced researchers is provided; the projects remain practitioner-centered in the service of student learning and useful products are produced and shared. In these projects, the interface between research and development is seamless. These action research and development projects correspond to technological research and may represent a more appropriate emphasis within educational scholarship than the forms of basic research more typically conducted in the natural and social sciences.

McGinn, Michelle K.

Strand B **Wednesday, April 3, 1996**
10:30 am — 12:00 pm
Regency C

Classroom Discourse as Situated Achievement in a Grade 6/7 Unit on Simple Machines

Recent conceptualizations of knowing and learning focus on the degree of participation in the practices of communities. Discursive practices are recognized as the most important and characteristic practices in many communities. This study investigated how different combinations of artifacts, social configurations, and physical arrangements give rise to different content and form of classroom discourse. Over a 4-month period, we collected data (videotaped activities, interviews, ethnographic observations, artifacts, and photographs) in a Grade 6/7 science class studying a unit on simple machines. The activity structures included whole-class and small-group conversations about teacher- and student-designed artifacts. This study describes how different artifacts, social configurations, and physical arrangements lead to different interactional spaces and participant roles, and, concomitantly, to different levels of participation in classroom conversations. The artifacts had important functions in maintaining and sequencing classroom conversations. Depending on the situation and the role of participants, artifacts served as resources for students' sense making. Each of the activity structures supported different dimensions of participating in conversations and, for this reason, we conclude that science educators teaching large classes should employ a mixture of these activity structures.

McGinnis, J. Randy

Strand D **Tuesday, April 2, 1996**
8:30 am — 10:00 am
Illinois Central

NSF Collaboratives for Excellence in Teachers' Preparation: Three Case Studies of Collaboration Used to Reform Teacher Preparation in Science and Mathematics

Fletcher Brown **Glen Bruckhart** **Elisabeth Charron** **Kathryn Cochran**
Rose Shaw **Barbara Nelson** **John Graves** **J. Randy McGinnis** **Tad Watanabe**

This symposium explores the role of collaboration in undergraduate science teacher preparation programs emphasizing connections with mathematics and technology. Symposium participants from the Rocky Mountain Teacher Education Collaborative (RMTEC), the Maryland Collaborative for Teacher Preparation (MCTP), and Montana's Systemic Teacher Excellence Preparation (STEP) will present, explain, and discuss three case studies investigating facets of collaboration. These are three funded NSF Collaboratives for Excellence in Teacher Preparation with the common denominator of attempting reform in science teacher education by using a multilevel, systemic approach.

McKenzie, Woodrow L.

Strand C **Tuesday, April 2, 1996**
2:30 pm — 3:30 pm
New York Central

The Transformation of a Graduate Teaching Assistant: A Case Study in Undergraduate Science Reform

George E. Glasson

The purpose of this paper is to chronicle the development of a Graduate Teaching Assistant (GTA) in geological sciences as she is introduced to teaching for the first time and is subsequently influenced by a project designed for systemic reform of undergraduate science education. This case study report examines the learning of Anne, a GTA, as she developed as a teacher and considered alternative pedagogical frameworks. Themes that emerged from this analysis of Anne's teaching include issues of classroom control, changes in assessment practices, and the pedagogical development of a lifelong teacher/learner. This case study was documented by developing an innovative multi-media portfolio as a tool for assessment and reflection. By showing a progression from traditional to more authentic teaching and assessment practices, this case provides an example of how reform is linked to assessment by enabling researchers and teachers to review and reflect on student and teacher learning.

McLoughlin, Andrea

Strand D **Tuesday, April 2, 1996**
4:00 pm — 5:00 pm
Regency C

The Evaluation of an Innovative Science Content Course for Prospective Elementary Teachers

Thomas Dana

The purpose of this study was to evaluate the first offering of an activity-based science content course for elementary education majors at a large research university. Interdisciplinary course material (incorporating biology, chemistry, earth science, and physics) was centered around problem-solving experiences as well as activities that supported the construction of pedagogical content knowledge. Naturalistic methods of inquiry (semi-structured interviews, open-ended questionnaires, document analyses, and field observations) were utilized to determine how well prospective teachers and their instructors thought the course achieved its goal of increasing science confidence, competence, and connection. Inductive analysis of the data revealed the following themes: a) learning science content in a pedagogical context meaningful to prospective teachers increases its perceived value, b) activity-based experiences help participants to construct meaning, c) increased opportunity for interaction enhances learning, and d) tension between student and instructor perceptions of a course may result in discrepancies between expectations and actualized outcomes. While there is a call for teacher preparation programs to invest in similar types of science courses, considerations should be given to student and instructor perceptions about expectations and goals, special needs of activity-based courses, and content and pedagogical knowledge integration.

McMahon, Maureen M.

Strand B **Monday, April 1, 1996**
10:30 am — 12:00 pm
Grand B

A Unique Chemistry Learning Environment: Multimedia Use in a Chemcom Classroom

William S. Harwood

The purpose of this study was to investigate attitudes of students regarding the use of interactive multimedia enhancement in a non-traditional high school chemistry classroom. A case study of one ChemCom classroom was conducted incorporating field observation data, student and teacher interviews and student interest surveys. Students in this non-traditional chemistry classroom reacted freely and candidly about the chemistry-multimedia interaction. Results indicated the majority of students viewed the interactive multimedia integration into their chemistry classroom as a positive inclusion. Student reasoning and rationale behind their beliefs about media use in the chemcom classroom are extremely thought provoking. Students detail the role the interactive multimedia played in assisting learning and understanding of chemistry content and concepts.

McRobbie, Campbell J.

Strand A **Wednesday, April 3, 1996**
10:30 am — 12:00 pm
Regency C

Of Whirling Balls and Orbiting Spaceships: The Consistency of Students' Talk about Circular Motion within and between Different Contexts

Wolff-Michael Roth Keith B. Lucas David Russell Campbell McRobbie

The investigation reported in the proposed paper is part of a larger study concerned with understanding learning as it emerges from the enacted curriculum which in itself is mediated by (a) students' views of the nature of science, beliefs about learning, and views of laboratory learning environment and (b) teachers' beliefs about knowing and learning science, and knowledge of student ideas about content. The purpose of the present study is to present an in depth analysis of students' talk about rotation phenomena with a particular focus on the consistency of this talk across different phenomena. The significance of the study relates to the fact that the investigation was conducted between two instructional cycles. It thus constitutes an inventory of students' ways of talking after one instructional cycle, and simultaneously an inventory of students' knowing before another physics unit that presupposed knowledge of the first instructional cycle.

Meadows, Lee

Strand C **Sunday, March 31, 1996**
7:00 pm — 8:30 pm
Wabash Cannonball

Reflections from a Year of Teaching in an Urban High School

Urban science education presents a unique set of challenges, especially in light of its lack of a strong literature base. I spent one day per week in an urban high school, but in contrast to many researchers' activities while in schools, I taught. In a university-school collaborative, I teamed with a veteran science teacher to teach physical science in an urban school serving almost exclusively African-American students. My research was conducted chiefly via constant comparative analysis of the reflective log of my experiences throughout the year. My findings focus on developing rapport with the teachers and my first understanding of teachers, students, and administrators.

Meyers, Karen

Strand F **Monday, April 1, 1996**
2:45 pm — 3:45 pm
Grand A

Mirror, Mirror on the Wall Who Is the Fairest of Them All?

Sharon Parsons

While recent research has focused on preservice and inservice science teachers examining their practice limited research however has been done by university science educators on their own practice. This session will report on two autobiographical studies by university science educators who are engaging in research into their practice in collaboration with elementary and middle school preservice teachers. One project is based at the University of British Columbia, and the other is at San Jose State University. The researchers have utilized a variety of forms of narrative inquiry to examine the dilemmas in their practice from multiple feminist perspectives. The outcomes of their research has implications both for the reform of their practice and new models of professional development for elementary and middle school science teachers.

Milne, Catherine

Strand H **Monday, April 1, 1996**
10:30 am — 12:00 pm
Burlington Route

Philosophically Correct Science Stories

People seem to think of science as composed of facts which should be presented in plain and unadorned language and therefore tend to believe that science does not present fertile ground for the development of stories. However, from an analysis of school science textbooks I identified four different types of science stories which indicate that stories play an important role in school science. I identified these stories as; (1) heroic, (2) discovery, (3) statement about, and (4) politically correct science stories. Each of these types of stories promotes a particular set of philosophical assumptions about science which are presented implicitly within the framework of the story as a truth of science. As teachers, we need to be critically aware of these assumptions since they may be at odds with our personal epistemologies and with our preferred pedagogy.

Minger, Mark A.

Strand B

Monday, April 1, 1996
8:30 am — 10:00 am
Grand E

Sex and Race Differences in 9th Grade Science Students' Perceptions of Their Learning Environments.

Frances Lawrenz Douglas Huffman Kirsten Bancroft

The importance of the learning environment in education is widely accepted, but little research has been done on the differences between groups of students within any particular classroom. The purpose of this study was to examine 9th grade science students' perceptions of the constructivist learning environment in their science classrooms by both sex and race. The 1,892 students from 13 different high schools throughout the United States completed a six scale modified version of Taylor, Fraser, and White's (1994) Constructivist Learning Environment Survey (CLES). The class mean scores for each of the six scales were analyzed by both sex and race of students and by both sex and race of teachers. Results indicated that there were differences on only one scale in students' perceptions of the learning environment by sex of student or sex of teacher. There were, however, several differences by race of student and race of teacher. The implications of these results for science teaching and research will be discussed.

Mintzes, Joel J.

Strand A

Monday, April 1, 1996
2:45 pm — 3:45 pm
Regency A

Knowledge Restructuring in the Life Sciences: A Longitudinal Study of Conceptual Change in Biology

N. Renee Pearsall Jo El J. Skipper

This study examined successive and progressive changes in the nature and structural complexity of knowledge held by introductory, college-level biology students and how those changes are affected by the students' primary learning mode and gender. To examine the way learners restructure knowledge over the course of a semester, subjects constructed concept maps at four week intervals throughout the semester. The maps were then evaluated for structural complexity and change based on the work of Novak and Gowin (1984) and Rumelhart and Norman (1978). Results suggest that a substantial amount of knowledge restructuring takes place and that much of it is incremental in nature; "accretion" and "tuning" accounting for 75% of the observed structural changes. Of potential importance however, is that "radical" changes involving higher order, superordinate concepts are concentrated in the first four weeks of the semester. The observed relationships between knowledge restructuring and predominant learning mode and gender are potentially significant. The evidence suggests that students who use "active," "deep" information processing strategies construct more elaborate, well-differentiated knowledge structures. Furthermore, it appears that gender may be an important mediator of meaningful learning. It is particularly notable that where gender differences were found, they tended to favor females.

Misiak, Julia Anne

Strand A

Monday, April 1, 1996
10:30 am — 12:00 pm
Wabash Cannonball

Influence of Algorithms Over Various Task Contexts

Rosie Allen-Noble Marilyn F. Hughes

The purpose of this study was to examine students' usage of algorithms for solving problems in different contexts. Twenty nine subjects were asked to solve 3 problems. The results were analyzed by correlating students' responses with a 5 step information processing schema suggested by Davis. The majority of subjects appeared to solve the problems parallel to the Davis model except for step 4, which required checking and monitoring their work. Results indicated that subjects for this study relied heavily upon algorithmic procedures and were consistent in their choice of algorithms over various contexts. The study also revealed some difficulties students encountered while mapping the algorithms in the problems of some contexts.

Morgan, Wayne R. **Strand A** **Tuesday, April 2, 1996**
10:30 am — 12:00 pm
Grand A

Assessing the Critical Thinking Strategies Utilized by Community College Chemistry Students

Emmett L. Wright

The purpose of this study was to investigate the instruction and assessment of critical thinking skills within the context of a community college science course. During the research study subjects enrolled in four laboratory sections of General Chemistry performed three unstructured laboratory activities that required them to identify unknown chemicals. Tests of background knowledge were administered prior to each of the activities. Two of the laboratory sections received direct, explicit instruction in several critical thinking skills prior to performing the first two activities. The effects of background knowledge and instruction were analyzed. There were no statistically significant differences in accuracy of identifying the unknowns between subjects identified as possessing high and low background knowledge on the basis of the background knowledge tests. Both high and low background knowledge subjects showed a statistically significant improvement in the relative number of tests conducted when the first activity was compared with the second and third. The effect size was larger for the low background knowledge group. Direct instruction resulted in significant improvements in the number of tests conducted but not in the accuracy of identifying the unknowns. Subjects provided narrative accounts for their reasons for making identification decisions which supported the quantitative findings.

Moscovici, Hedy **Strand A** **Tuesday, April 2, 1996**
8:30 am — 10:00 am
Missouri Pacific

Biology 101: A Constructivist Perspective on Teaching Undergraduate Non-Major College Biology

The goal of this study was to analyze the dynamics of learning in a college biology course for undergraduate students not majoring in biology. Other biology and/or science education faculty and some students enrolled in this class were instrumental in the process of interpretation. Departing from the lecture style, the class was organized around group-oriented presentations and writing. Classroom tests and quizzes concentrated on open-ended essay questions using the biology text as a resource. Results of the study show that despite requiring a larger investment of time, most students felt they learned more in this class because it allowed them to show what they learned and to ask for clarification and provide suggestions to improve their learning experience. The students also liked that the testing encouraged them to express learning and understanding rather than simply evaluating their memorization capacity.

Muire, Chris **Strand E** **Monday, April 1, 1996**
8:30 am — 10:00 am
Midnight Special

An Analysis of Elementary Teachers' Need in Mathematics and Science

The purpose of this study is to determine what Florida's elementary teachers believe are their most important needs with regard to improving instruction in mathematics and science. These needs are then reviewed in a context that takes into account goals set forth by various national and state education reform initiatives. The data are qualitative accounts from teachers around the state that provide contextualized information on their needs. These are needs as they are perceived by K-5 practitioners who are expected to initiate changes in classrooms and craft environments that are more conducive to the meaningful learning of their students. These needs shape the goals and expectations of prospective and practicing teachers when they seek or are involved in professional development activities. In a sense, they are the starting point for the initiation of reform and as such, their voices and their needs are significant inputs for improving the programs for prospective mathematics and science courses at the post-secondary level. These data provide a unique opportunity to provide a description that is critical for science and mathematics teacher educators.

Murfin, Brian

Strand D **Monday, April 1, 1996**
4:00 pm — 5:30 pm
Grand B

Multicultural Science and Teacher Education

Multicultural science can be defined as the study of science in different cultures in an attempt to describe the relationship between science and culture. In this program the history and nature of science and technology in non-Western cultures is investigated, and in the process, the students are encouraged to create links to topics in their own or commonly used science syllabi and curricula. There is a constant search for new ideas for hands-on science activities which include content and perspectives from different cultures. Another very important aspect of the course is that controversial issues related to culture and science are discussed. Computer conferencing with the teacher as moderator has proven to be very effective as a forum for this discussion. Technology plays a very important role throughout the entire course. The students do extensive searches of the resources available on the Internet. Perhaps the most important aspect of this course is the constructivist approach taken where the students, through research and collaborative projects, participate in gathering, and validating new information on science in different cultures.

Naizer, Gilbert L.

Strand D **Monday, April 1, 1996**
2:45 pm — 3:45 pm
Grand C

Preservice Elementary Teachers' Representations of Science: Photography of Science in Your Neighborhood

Scientific literacy for all students is a major goal of science teachers nationwide. One aspect of scientific literacy is recognizing and appreciating science in everyday situations (Rutherford & Ahlgren, 1990). While numerous studies have examined students' definitions of science, their conception of the nature of science, and/or science misconceptions, few have examined what students perceive as science within their everyday lives. Preservice elementary school teachers often have the same perceptions/misconceptions as elementary school students. This study utilized a unique approach to examine preservice elementary students' perceptions of science within everyday experiences in their homes and neighborhoods. Students were provided with single-use cameras and given the instructions: take pictures of science you see in your home and neighborhood and keep a list of the pictures you take and why it is science. The photographs were sorted and analyzed to identify patterns and differences. Photographs of technology (e.g., household appliances) were by far the most common, while the earth sciences were minimally represented.

Nakhleh, Mary B.

Strand A **Monday, April 1, 1996**
1:00 pm — 2:30 pm
Grand D

Action Research in Undergraduate Chemistry: Results from Project REMODEL.

Kristin Lowrey

In REMODEL, we set out to narrow the gap between students' conceptual and algorithmic understanding in freshman chemistry using an action research model. We implemented and evaluated innovations in lecture, laboratory, and assessment for the two-semester introductory sequence for majors, in order to provide data on effective innovations and data on the barriers to successful reform. This paper reports on lecture and assessment innovations in the first and second semester course for chemistry majors from spring of 1994 through spring of 1995. In lecture, students engaged in interactive group work in special lecture sessions. These special sessions gave students opportunities to think about and defend their understanding of chemical concepts. The nature of the assessment in the courses moved from a heavy emphasis on mathematical problem solving to a mix of conceptual questions and more traditional problem solving questions involving the use of algorithms. This mix of exam questions probed the students' understanding of the concepts involved in a topic and the use of those concepts in problem solving applications. Results indicate a substantial closing of the gap between conceptual and algorithmic understanding.

Niaz, Monsoor

Strand H **Wednesday, April 3, 1996**
10:30 am — 12:00 pm
Wabash Cannonball

Baroque Tower on a Gothic Base: A Lakatosian Reconstruction of Students' and Teachers' Understanding of Structure of the Atom

Rafael Blanco

Given the importance of the parallel between the process of theory development by scientists and an individual's acquisition of knowledge, the objective of this study is to reconstruct students' and teachers' understanding of structure of the atom. Freshman students (n=171) enrolled in Chemistry I and 7 chemistry teachers were asked to respond to a 11-item questionnaire (based on a historical development of structure of the atom) and encouraged to explain their responses in writing. Results obtained show that Ss and teachers: a) mostly have a very similar positivist understanding of the progress of science, some were transitional and very few had a Lakatosian perspective; b) are inconsistent in their responses by switching from a positivist response on one item to a Lakatosian on another; c) also showed some consistent response patterns by resisting changes in some of their 'core beliefs' by invoking 'auxiliary hypotheses'; and d) consider that empirically observable hard experimental facts give science its objective status, whereas the interpretations go beyond the fold of science.

Nichols, Kim

Strand D **Monday, April 1, 1996**
1:00 pm — 2:30 pm
Illinois Central

An Historical Examination of Science Teachers' Use of Science as a Way of Knowing as an Instructional Organizer

The objectives of the study being reported here were two fold. The researchers have attempted to determine (1) whether the teaching of science as a way of knowing and creation of intellectually independent students was a persistent theme or thread in the science education literature of the past and (2) if it is a persistent theme, what conclusions can be drawn concerning its significance or lasting influence as a means of informing the current reform efforts? Regarding the first research question the evidence shows conclusively that these are not notions of recent origin; they have been espoused continually. In every science education reform of the last 100 years, the ideas have been clearly enunciated and taken in as a piece of the reform. Regarding the second research question, the literature examination revealed numerous factors which impacted upon the representation of these notions in classroom practice. These factors included: inadequate teacher preparation, administratively controlled classroom management styles, stringent college entrance requirements, lack of unity regarding goals, lack of clarity regarding goals, lack of the means to translate goals to practice, overcrowded curricula, and a lack of understanding regarding how to assess attainment of these goals.

Nichols, Sharon

Strand H **Sunday, March 31, 1996**
7:00 pm — 8:30 pm
New York Central

Revisioning Science Teaching and Learning Through 'Multicultural' Science and Feminist Frameworks

Deborah Tippins **Leslie Parker** **Sue Stocklmayer** **Catherine Milne**
Anita Roychoudhury

The purpose of this symposium is to critique how science has traditionally been represented as Western ideology and to revision teaching of 'multicultural' science. Discussions of feminists and multiculturalists are brought together in this session to offer theoretical and practical insights for revisioning science as an equitable learning experience for all learners. Feminist claims provide the backdrop to argue that science has tended to exclusionarily represent Western views. In this session, several studies are presented which explicate how science in educational texts has historically and mythically represented a Western or 'masculine' view of science. Examples from these studies explore how 'other' cultural views of natural phenomena reflect ways of thinking that have been denied in dialogues concerning what constitutes 'legitimate' science. We consider the notion that culture begins with the individual, thus 'multicultural' in the studies represented gives reference to personal referents teacher and students bring to the science learning context.

Nickelson, Dennis

Strand E **Monday, April 1, 1996**
2:45 pm — 3:45 pm
Burlington Route

Portfolio Assessment in High School Physics

The purpose of this study was to develop a rubric to ascertain the quality of student portfolios in high school physics and to use the rubric to compare portfolio scores of students working in cooperative learning groups and students working independently. The scores were used to determine if there was a relationship between the portfolio score and other more traditional measures of achievement. The types of documents in student portfolios were examined. Ninety-five students in four physics classes of a midwestern high school developed portfolios based on course goals. A coefficient of concordance of 0.89, $p. < 0.001$, was determined among the scores produced by three physics teachers using the rubric to score 20 randomly selected portfolios. Frequency tables were used to ascertain the types of documents used to develop portfolios. Wilcoxon Rank Sum tests indicated no difference between the scores of students working in cooperative learning groups and students working independently to develop portfolios for both the portfolio and traditional course grade. Spearman correlation coefficients were determined between portfolio scores and traditional measures of achievement and GPA and ACT scores. All of the relationships were significant ($p. < 0.05$) except for the final exam and ACT scores for the students working independently.

Nicolaos, Valanides

Strand A **Tuesday, April 2, 1996**
10:30 am — 12:00 pm
Wabash Cannonball

Prospective Elementary School Teachers' Conceptions of the Changes Relating to Distillation

One-to-one interviews were administered to a random sample of thirty female, prospective elementary school teachers of differing backgrounds in science. A distillation apparatus accompanied by a diagram was presented to each student and its use for distilling liquids was fully discussed. Students were asked to describe the macroscopic and microscopic changes that would occur when different liquids (tap water, sugar or salt solution, alcoholic solution, tea, coke, and red wine) were distilled. The majority of the students did not develop appropriate concepts related to boiling point, latent heat of evaporation, and fractional distillation. They had also difficulties in realizing the effects of distillation on water solutions and proposed that the product of distillation would not change taste and colour or that the taste and the colour would be lighter. Misconceptions related to the nature of evaporation and liquefaction and the effects of temperature on the size, the weight, the composition, and the energy of molecules were also identified. These difficulties were progressively greater for salt solution, sugar solution, tap water, mixture of alcohol and water, tea, and coke or wine. Implications of students' conceptions on curriculum planning and teaching practices conducive to conceptual growth are discussed.

Niedderer, Hans

Strand A **Tuesday, April 2, 1996**
8:30 am — 10:00 am
Grand B

Learning Processes in Electric Circuits

Fred Goldberg

Learning processes of three college students (prospective elementary school teachers) in the content area of electric circuits were investigated in a tutorial study. Empirical evidence for learning pathways and knowledge construction is generated from an interpretive analysis of transcripts of two out of six tutorial sessions. In these sessions, the students use hands-on experiments and special computer software. Their learning pathways are described by subsequent cognitive states with some stability (conceptions) and transition processes in between them, starting with a prior conception "everyday current" (well known from previous research) and coming to three new intermediate conceptions "positive and negative current," "microscopic view of current," and "current with electron pressure." The first and second of these intermediate conceptions were not intended by the teacher, thus showing examples for the self development of students' cognitive systems in a given educational setting. Further analysis also results in hypotheses of some cognitive tools which are used by students in their construction processes, resulting in the transition from one (intermediate) conception to the other. Finally, some hypotheses about effects of specific elements of teaching on knowledge construction are discussed.

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Nodurft, Susan J.

Strand D **Tuesday, April 2, 1996**
4:00 pm — 5:00 pm
Grand C

Examining the Usefulness of Field Trip Attitude Assessment Procedures in Affecting Preservice Teacher Change

Joyce M. Roberts **Craig W. Bowen**

This paper addresses the question: Can attitude assessment data of different forms positively affect teacher change toward incorporating field trips into their curricula? The study began with the preparation of attitude questionnaires of three types to be administered to students following natural field trip excursions. A Likert form was devised to obtain data quantitatively, and scenario and open-ended forms composed to acquire qualitative data. Seventy-four students from six schools participated in this phase. Student data were summarized for inclusion into three forms of preservice teacher packets (Form A Likert, Form B Scenario and Form C Open-ended data summaries). Likert and open-ended questions on the teacher questionnaire were designed to assess the dimensions of efficiency, convincability and accuracy of the data summaries. Preservice teachers (N=45) enrolled in two different science methods classes participated in the second phase by evaluating one of the above student data forms. Analysis of the quantitative data from the teacher questionnaire indicated that the open-ended presentation had the highest positive score in terms of convincing the preservice teachers to consider using field experiences. Qualitative data analysis confirmed that anecdotal communications had the greatest positive response with the open-ended presentation appearing to exert the most persuasive influence.

Norman, Katherine I.

Strand D **Monday, April 1, 1996**
10:30 am — 12:00 pm
Jeffersonian

Science Education on the Texas/Mexico Border: Science Teaching Practices

The purpose of this study was to examine teaching practices in secondary science classrooms on the United States/Mexico border, with an emphasis on the identification of effective teaching methodologies. The location of the University one block from the border and the commitment of the University to the border culture facilitated the investigation. The researcher visited secondary science classes in Matamoros, Mexico and in Brownsville, Texas where she conducted observations, interviews, document analysis, and audio and video taping. Surveys of administrators, science teachers and students were conducted, which inquired a bout science education programs and practices. Matamoros science students demonstrated a high level of interest and concentration. The Matamoros classrooms were simple and plain; there was an absence of audiovisual aids; and science laboratories were not often used. In Matamoros lecture, teacher modeling, cooperative learning, and student presentations were the primary methods used. Teaching methods observed in Brownsville included lecture, labs, cooperative learning activities, and text assignments. Further science education research should be conducted in public and private schools that are part of border communities. The research should be collaborative, involving educators from both countries in stages: planning, conducting, evaluating, and disseminating results.

Norman, Katherine I.

Strand D **Tuesday, April 2, 1996**
10:30 am — 12:00 pm
Illinois Central

Case Study: The Lower Rio Grande Valley Regional Collaborative for Excellence in Science Teaching

This paper presentation will explain the goals, activities and outcomes of one of the Texas Regional Collaboratives for Excellence in Science Teaching. This Lower Rio Grande Valley Collaborative is based at The University of Texas at Brownsville, and involves public and private school teachers and administrators, as well as university faculty in science education, educational technology and the sciences. Collaborative events are coordinated with activities of Brownsville's NSF Partnership for Minority Student Achievement, Project BEAMS (Brownsville Engineering Alliances for Minority Students). The Regional Collaborative was begun in the spring of 1995, and is committed to staff development for middle school science teachers. Collaborative programs have emphasized the integration of Science and Technology, and teaching methodologies and content for Thematic Science Instruction. The program components have included a needs assessment; a series of computer workshops; a graduate course that focused on science teaching using INTERNET and science software; and a Summer Conference devoted to Science, Technology and Society. During this paper presentation, the participating teacher and students population will be described. Results of the needs assessment will be presented, along with a summary of subsequent Collaborative activities and the initial evaluation outcomes. Plans for future staff development programs and collaboration endeavors with local business and community leaders will be detailed.

Norman, Obed

Strand C **Tuesday, April 2, 1996**
4:00 pm — 5:00 pm
Grand B

Exploring Elementary Teachers' Conceptions of Science Knowledge in a Problem Solving Context

This study was aimed at elucidating elementary school teachers' conception of science knowledge in the context of problem-solving activities. The context used in the study was one in which the teachers were learners grappling with science concepts of sufficient complexity to challenge and stretch but not overwhelm. Observing teachers in such a learning context and analyzing their intellectual and logistical strategizing has the potential of yielding valuable insights into teachers' conception of science knowledge especially as it relates to their understanding of the ultimate goal of the inquiry process. Some of the problem solving context used in this study involved experimentation while others involved verification type activities. All interactions were audio taped and analyzed. Many of the interactions revealed a greater preoccupation with executing a perceived task and obtaining a desired result or answer as opposed to emphasizing the exploration or mastering of concepts. These findings provided valuable insights into teachers' conception of science knowledge. The conception held by teachers impact their classroom practice and are a crucial component of their pedagogical content knowledge.

Odom, Louis

Strand A **Wednesday, April 3, 1996**
10:30 am — 12:00 pm
Grand C

The Effectiveness of Concept Mapping and the Learning Cycle at Promoting Understanding of Diffusion and Osmosis Concepts

Paul Kelly

This study explored the effectiveness of concept mapping, the learning cycle, expository, and concept mapping/learning cycle combined teaching methods at promoting conceptual understanding of diffusion and osmosis . Four high school biology classes were taught diffusion and osmosis concepts with the above treatments. Conceptual understanding was assessed the day after and seven weeks after instruction with the Diffusion and Osmosis Diagnostic Test. The results indicated the concept mapping/learning cycle and concept mapping treatment groups significantly out performed the expository group in conceptual understanding of diffusion and osmosis. The concept mapping/learning cycle group had the top score on 9 of 12 items on the Diffusion and Osmosis Diagnostic Test. The concept mapping treatment group had the top score on 3 of 12 items on the test. This study provides evidence that expository treatment and learning cycle treatment alone are inferior at teaching diffusion and osmosis concepts. The presentation will provide a detailed description of the treatment groups and implications for high school biology teachers.

Ogunsola-Bandele, Mercy F.

Strand F **Tuesday, April 2, 1996**
4:00 pm — 5:00 pm
Grand A

Gender-Related Differences in Error Analysis of Some Nigerian High School Students in Practical Biology

Faulatu K. Lawan

The purpose of this study was to analyse the errors made by high school students in practical biology and the extent to which boys and girls differ in terms of the frequency of errors committed. For this purpose, 317 students, from the twelfth grade (senior secondary three), sampled from five different schools were used for the study. A criterion level of 0.05 was set to test the two null hypothesis, namely - there is no significant difference in error types between schools, and there is no significant difference in the frequency of error types committed by boys and girls in practical biology examinations. To test these hypothesis the one-way analysis of variance and the chi-square statistics were used respectively. The results of the analyses showed that all the subjects committed certain degrees of errors which differ from school to school. These errors are gender-related with the girls committing less errors than the boys. Possible explanation to the above findings and suggestions are discussed.

Okebukola, Peter A. O.

Strand A **Tuesday, April 2, 1996**
4:00 pm — 5:00 pm
Regency C

Examining the Potential of Concept Mapping in Lowering the Perceived Difficulty Level of Biological Concepts

Olugbemiro J. Jegede

Concept mapping is a metalearning strategy that involves organizing subordinate and superordinate concepts in a discipline into meaningfully connected entities analogous to a road map. The potential of the strategy for lowering the perceived difficulty level of biological concepts was explored in this study which involved 241 pre-degree biology students. Seven topics that were perceived to be most difficult by the subjects in the study were taught using the concept-mapping technique to a group (N=120), while the other group (N=121) received "regular" instruction. The results showed that the students in the concept mapping group had a significant lowering of their perception of difficulty of all the topics. The comparison group students still found the mechanism of inheritance and energy changes in the ecosystem to be highly difficult in spite of instruction which lasted a total of fourteen weeks. The implications of the findings for further research and for biology teaching are drawn.

Oliveira, Mauricia

Strand E **Tuesday, April 2, 1996**
10:30 am — 12:00 pm
Jeffersonian

Does a Science Curriculum Discipline Focused on Lab Activities Promote Creativity and Critical Thinking?

Margarida S. Neves

The purpose of the study was to evaluate if the development and implementation of a brand-new science curriculum discipline, emerged from the educational reform and focused only on lab-activities, promotes creativity and critical thinking. The Ennis's taxonomy of critical thinking dispositions and abilities and a creativity checklist developed by the authors were the instruments used to perform the document analysis of the intended curriculum (official documents) and of the implemented curriculum (textbooks and text materials prepared by the secondary physics teachers involved). Findings indicate a clear gap between official policy and actual practice concerning those two forms of thinking, giving clues to how teachers implement policy in classrooms and how to intervene in preservice and inservice science teaching toward a creative and critical thinking model of teaching.

Oliver, Steve

Strand D **Monday, April 1, 1996**
1:00 pm — 2:30 pm
Illinois Central

A Framework for Teaching "How Can You Know?"

The framework which underlies the teacher enhancement project reported here focused on the belief that students will be motivated to learn science when they come to understand the rational nature through which science has progressed. The framework presented to the teachers during two summers of an NSF teacher enhancement workshop consisted of 5 themes. These themes are history, description, association, experimentation, and modeling. The workshop teachers became users of this approach and developed curriculum materials based on these themes. It was intended that teachers would use these themes to extend beyond the idea of process skills, in a way that students would explicitly learn how they can come to know based on evidence. The application of these curriculum materials and other uses of a "how can we know" approach to teaching were evaluated throughout an academic school year. The specific results of this application are detailed in other papers within the paper set.

Olness, Valerie Keeling

Strand B **Monday, April 1, 1996**
1:00 pm — 2:30 pm
Grand E

Effect of Incorporating Reflective Writing into the Teaching of Evolution to a High School Biology Class

Fred N. Finley

The purposes of this study were to evaluate the effectiveness of a reflective journal writing strategy on improving students' knowledge and conceptual understanding of evolution and their perceptions of the tentative nature of science, and to evaluate its effect on gender. Two sections of general biology students were designated as the experimental group and two sections as the control group. For three weeks, all students received identical content instruction, and the experimental group was given time at the end of each lesson to individually reflect on the content of the lesson. Gains in achievement, or changes in perception about the nature of science, were assessed using pre and post treatment administrations of an objective test, a survey instrument, and selected items from the VOSTS instrument. Students' attitudes towards the treatment were assessed with an attitudinal survey, an event analysis, and interviews. Qualitative analyses indicated that the students perceived the process in a positive manner - they believed reflective writing and the ensuing questions were the strategies that had caused them to learn the most. Statistical analysis indicated there was no significant gain in achievement, or change in how students viewed the nature of science, and there was no consistent gender interaction effect.

Orion, Nir

Strand B **Monday, April 1, 1996**
4:00 pm — 5:30 pm
Grand E

Student's Perception of Cooperative Learning in Earth-Science Fieldwork

Richard Kempa

This study sought to examine students' views on team learning in the context of field-work in an earth science programme. Particular attention was paid to students' views on the composition of working groups and choice of working partners and students' perception of their own learning from and in team activities. The sample consisted of 44 high school students from grades 10-12. The inquiry was conducted by a 20-item questionnaire. Some of them asked for straightforward factual information, others invited brief open-ended statements. The evaluation of students' open-ended statements was conducted by network analysis. The general findings may be summarized thus: (i) Students seemed to be divided between choosing partners because they could contribute to the solution of learning tasks and for reasons of personal relationship. (ii) Students appreciated that the presence of a variety of expertise can be helpful in group learning, provided that there exists a common commitment. (iii) The general view held by students was that their team activities had been successful in terms of generating a solution to learning problems and also as a method of learning. However, some students saw themselves mainly as contributors to, rather than beneficiaries from, group work.

Padilla, Michael J.

Strand E **Sunday, March 31, 1996**
8:30 pm — 10:00 pm
Regency A, B, C

Evaluating Industry-Produced Curriculum Materials: An Analysis of the Exxon Energy Cube

Deborah J. Tippins **Katherine Wieseman**

During recent years numerous industries, such as the Exxon Education Foundation, have produced science curriculum materials. Many industry-produced curriculum materials exist, but few have been thoroughly evaluated. This study provides a model for evaluating such materials and an example of how such evaluation might serve as a basis for revising the materials to correspond to current science education reform initiatives. The results of this evaluation reveal that teachers using the materials perceive the Exxon Energy Cube to be highly useful, and to extend and reinforce topics already being taught. Opinions about the degree to which the materials facilitate student learning about energy and the environment are very positive, albeit areas for improvement exist. For example, the comprehension level of the materials appears problematic for certain student groups, namely the unmotivated or academically low student. Additionally, teachers offer suggestions for improvement including adding material that incorporates STS approaches, technological applications, as well as suggesting physical and conceptual changes to the materials themselves. A significant and hopefully fruitful outcome of this study is the Foundation's decision to revise the materials according to major themes in the National Science Education Standards.

Palmer, Troy D.

Strand G **Sunday, March 31, 1996**
7:00 pm — 8:30 pm
Frisco

Cognitive and Affective Outcomes Resulting from State-Wide Field Testing of an Interactive Multimedia Environmental Science Program

The purpose of this study was to evaluate the interactive multimedia science program, EcoVentures: Learning in Florida's Environment, during its final formative stages. More than 600 grade 5-9 science students and teachers across Florida participated in a study designed to: (1) determine the benefits and problems encountered by EcoVentures users; (2) evaluate EcoVentures ' effectiveness in fostering positive cognitive and affective outcomes; and (3) identify program changes that should be made prior to final production. Statistical data analyses indicated that students learned more in the same amount of time using EcoVentures when compared to traditional instructional methods. In addition, narrative comments from teachers and students support assertions that EcoVentures: (a) allows for great flexibility within the context of a science unit; (b) provides more learner control than the regular curriculum; (c) emphasizes higher-order thinking skills; (d) promotes learning transfer to real life; (e) fosters a sense of environmental awareness within students; and (f) motivates students by placing them in simulated, realistic situations that extend their learning experiences beyond the science classroom.

Palmeri, Amy B.

Strand C **Tuesday, April 2, 1996**
10:30 am — 12:00 pm
Missouri Pacific

The Beliefs and Science Teaching Practices of Four QUEST Teachers

This case study examined the science beliefs and science teaching practices of four second-grade teachers involved in the QUEST Project at Indiana University. Data illustrating the role of beliefs in guiding the practice of each teacher came from five interviews, two full-day observations, four science lesson observations (three of which were videotaped), and a Beliefs Questionnaire requiring information regarding beliefs about science, learning science, and teaching science. Data were collected from September 1994 through February 1995. The data analysis focused on (1) the teachers' beliefs about science and science pedagogy, (2) the teachers' operational curricula, and (3) the teachers' science teaching practices. Over the course of the study, each teacher maintained a high level of consistency between her beliefs about science, science pedagogy, operational curriculum, and teaching practices. At each step toward implementing their beliefs the teachers made slight modifications to their beliefs, operational curricula, or teaching practice in order for them to maintain a degree of self- perceived internal consistency. For three of the four teachers, the summation of these slight modifications led to a marked difference when comparing the overall enactment of their beliefs into practice.

Parke, Helen M.

Strand D **Monday, April 1, 1996**
8:30 am — 10:00 am
Jeffersonian

Teachers as Leaders in Staff Development: Implications for Classroom Practice

The purpose of this research is to examine through interviews the impact on practice when teachers redesign their assessment strategies and also become leaders in assessment staff development for colleagues. This paper will explicate teachers' views of formal and informal assessment strategies as well as examine how teachers placed in this leadership role become reflective in ways that implicate their practice. These teachers are careful in their design of staff development to model reform perspectives concerning curriculum and assessment.

Parke, Helen M.

Strand G **Monday, April 1, 1996**
8:30 am — 10:00 am
Jeffersonian

A Model for Integrating Environmental Science with the K-12 School Curriculum Using Computational Technologies through Computational Training for Teacher Enhancement, Action, and Motivation

Charles R. Coble

This presentation will examine research data collected from two years of an NSF project that links a small rural school district to community, university, and computational science resources. The project supports the district in building curriculum units tied to local environmental issues and in training teachers to maneuver the concomitant technologies. A multigrade sequence of science lessons has been developed which ties together the products of students in the elementary, middle grades, and secondary schools. In the early grades students focus on simple simulations and visual representations. In the middle grades they deal with dynamic models and student representations. In the high school students work with numerical methods and computational simulations. As teachers develop the materials they are being placed on Internet access. Teachers also use Internet to communicate with the university and the supercomputing center. Research data will include teacher interviews and outside evaluation of student progress.

Parker, Joyce

Strand E **Monday, April 1, 1996**
4:00 pm — 5:30 pm
Jeffersonian

Secondary Science Teaching Analysis Matrix: A New Instrument for Studying Secondary Science Teaching

Donald Duggan-Haas

Secondary science teachers employ varied models in their teaching including didactic, conceptual, conceptual change, constructivist, and inquiry approaches. Instruments and schemes that are available to record and analyze science teaching often are based on a very limited range of models of science teaching. As a result these instruments do not aid observers and researchers in easily recording and documenting variations in approaches used in teaching science. The Secondary Science Teaching Analysis Matrix (SSTAM), developed for use in the Salish study of new secondary science teachers, provides a new means for examining teaching styles in secondary science classes. Based on a wide array of multi-national and multi-cultural observations in secondary science classrooms, SSTAM allows for detailed recording and analysis of classroom observations both directly and from videotapes. In this presentation, development, validation, and use of this new instrument will be discussed.

Parker, Lesley H.

Strand F **Tuesday, April 2, 1996**
2:30 pm — 3:30 pm
Grand A

Gender & Assessment of Physics in Context: Getting It Right!

Lesley H. Parker **Léonie J. Rennie** **Gaell M. Hildebrand** **Elizabeth Hazel**

At a broad level, the aim of this interactive symposium is to explore the parameters of fair and equitable assessment in science. The particular focus is on the links between gender and the introduction of real-world contexts into assessment in physics. Specifically, the objectives of the symposium are (i) to present examples of research which have examined some of the gender-related implications of context-based assessment in physics, from the perspectives of the high school students and teachers, and university students; (ii) in collaboration with those attending the symposium, to apply the findings of the research presented in (i) in an interrogation of traditional concepts of fairness and validity in science assessment; and (iii) to interpret the discussion in (ii) in terms of its implications for practitioners engaging in fair and equitable assessment in science and for researchers engaging in further exploration of this area.

Parsons, Sharon

Strand D

Tuesday, April 2, 1996
10:30 am — 12:00 pm
Regency B

Establishing a Science Education Learning Community: Preservice/Inservice Teachers and Teacher Educators as Co-Learners

This paper reports on the outcomes of an ongoing action research project with preservice/inservice elementary teachers who are attempting to bring a science emphasis to their teaching. A project which is not only working towards improving practice but also working towards self-empowerment of elementary teachers in science. The project's focus is on the creation of an emancipatory action research climate where teachers have a strong voice. The effort to move from a traditional university-driven model of professional development for science education to one that leads to teacher-driven, emancipatory practice at the classroom level began in the Fall of 1993. Since that time we have: (1) established a collaborative relationship among student teachers, classroom teachers, and university faculty that has resulted in a community of co-learners, and (2) explored strategies to move from research which is theory driven, to theory generating research. Results to date (1) have implications for expectations of the amount of time necessary to effect local systemic change as well as the multiplicity of tasks at many levels that must be carried out, and (2) confirms the value of long term investments of resources for reform agendas which will lead to new models and frameworks for professional development in science education.

Patterson, B. Patricia

Strand D

Monday, April 1, 1996
10:30 am — 12:00 pm
Jeffersonian

The Process of Changing Science Teaching Paradigms among College Science Faculty: A Case Study of Collaboration at a Small College

A collaborative project to improve presentation of biology content to non-science majors has brought a science educator and science faculty together at a small college. Lecture notes previously presented in a linear fashion on overheads were converted to a series of "expert" concept maps in which content was visually represented as related concepts. These maps were presented to students on overheads and handed out to serve as study guides and reference points. Initial skepticism changed to enthusiasm, as work to develop the maps progressed. Faculty reported a gain of insight into conceptual gaps they had created for students when previously lecturing from linear notes; and after their first presentation, understood the value of the maps for improved content understanding among students. Anecdotal data is presented as evidence that these faculty are taking a first step toward a constructivist paradigm of teaching as a result of this activity, but still cling to many of their receptive beliefs about science learning. Evidence will be presented that the faculty view of students is still largely receptive; and the concept of student-centered instruction is not fully understood. As this collaboration continues a practical model for effecting paradigm shifts is emerging and is postulated as part of this presentation,

Pedersen, Jon E.

Strand C

Monday, April 1, 1996
10:30 am — 12:00 pm
Missouri Pacific

Beliefs of Science Teachers Towards the Implementation of Controversial Social/Technological Issues as Part of the Extant Curriculum

Kristy Spivey

We, as science educators, must view the changing nature of society brought on by technology and the global nature of society as an impetus to re-examine the nature of our science instruction. We have been bestowed with the responsibility to educate students on a variety of topics that, less then two decades ago, did not exist. Many of these topics are controversial in nature and are directly linked to the global community in which we exist. However, including these controversial issues in the extant curriculum of science has, at best, been limited. The current study examines a group of science teachers' beliefs about the implementation of controversial social/technological issues in the extant science curriculum. Beliefs were measured by a 44-item Likert type instrument designed by the authors. Indications are that teachers feel controversial topics are important to study, yet lack the support from communities to implement such controversial topics.

Peters, Joseph

Strand G **Sunday, March 31, 1996**
7:00 pm — 8:30 pm
Midnight Special

Access of NARST'S World Wide Web Internet Server and the Development of Similar Servers

This session is designed to be an interactive demonstration and discussion of the development and use of NARST's Internet World Wide Web (WWW) Server. The focus is on providing software and support for novice computer users who wish to use this tool in their teaching and research. The facilitator will provide the necessary information on how to access the server and will encourage questions from the audience as various aspects of the WWW are presented online. Resource materials for development of similar servers will also be provided and discussed.

Peterson, Rita W.

Strand B **Tuesday, April 2, 1996**
4:00 pm — 5:00 pm
Illinois Central

Children's Art about Science Offers Glimpses of Visual-Spatial Competence and Development

This study has two purposes: (1) to explore the potential value of children's art about science as an indicator of their prior knowledge about science and/or their newly acquired knowledge of science following instruction; and (2) to investigate children's art about science as an indicator of the development of visual-spatial thinking, reasoning, and creative competence during the elementary and middle school years. The presentation includes children's art about science, along with commentary on the procedures used and the findings from the study. Students who are able to recall and visually represent science information that portrays natural objects, phenomena or processes which have biological, geological, chemical or physical science origins, are advantaged over students who rely solely upon verbal descriptions of these same natural objects, phenomena or processes. Moreover, children's art about science provides glimpses into the neuro-cognitive development of visual-spatial competence and creativity during childhood and adolescence, suggesting the potential for broader theoretical significance in terms of multiple intelligences theory (Gardner,1995), neuro-developmental variation theory (Levine, 1995), and emotional intelligence theory (Goleman, 1995). Future study will seek to clarify relationships between visual-spatial competence, language competence, and other aspects of neuro-cognitive development.

Petrosino, Anthony

Strand G **Monday, April 1, 1996**
8:30 am — 10:00 am
Frisco

Advanced Technologies in a Project-Based Classroom: A Case Study

Bill Rodriquez **Sean Brophy**

The case study presented here was conducted over a two week period in which the researcher attended the participating teacher's class for ten regularly scheduled periods. A number of themes reappear throughout the participating teacher's implementation of the curriculum that significantly enhance our understanding of project-based science instruction. These themes include 1) an obvious attempt by the teacher to bring into the class the sense of "project" or "case", 2) an emphasis on the importance of collaboration and the expansion of the classroom beyond the walls of the school, and finally 3) the cyclic nature of the instruction and the teacher's notion of distributed expertise.

Plummer, Donna M.

Strand E **Monday, April 1, 1996**
10:30 am — 12:00 pm
Regency A

Development and Validation of an Attitudes Toward Graphing Questionnaire for Nonscience Majors

Robin Hurst-March

The purpose of this study was to develop a valid instrument to determine the graphing attitudes in an introductory biology laboratory course for nonmajors. The questionnaire was adapted from a Thinking-Feeling-Acting Questionnaire developed by Heinze-Fry (1987) in a study of student concept mapping. The graphing adapted questionnaire consisted of 22 items on a Likert scale with 2 of the items related to the use of graphs in students' lives. A statistical analysis of the questionnaire responses produced a coefficient alpha of 0.85.

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Ponte De Chacin, Carmen

Strand I

Tuesday, April 2, 1996
8:30 am — 10:00 am
Frisco

Uso de los Mapas de Conceptos como Herramienta para Procesar Articulos de Periódicos Relacionados con la Problematica Ambiental

El propósito de este estudio fue describir el uso de los mapas conceptuales como una herramienta para procesar la informacion de tipo ambiental contenida en los periódicos. Los sujetos de este estudio fueron estudiantes de pregrado de los módulos 911 y 919 de diferentes especialidades del Instituto Pedagógico de Caracas. Como producto del trabajo se obtuvieron 9 hemerografías relacionadas con problemas ambientales. Entre las cuales se destaca el problema del Amazonas por la explotación del oro. Entrevistas realizadas a los participantes, después de ocho semanas, revelan una opinión positiva hacia el uso de los mapas y una retención de casi el 80 % de los conceptos. Los resultados del estudio permiten concluir que los mapas de conceptos constituyen una excelente herramienta para procesar y transferir la información ambiental contenida en periódicos y revistas. Esta fuente de conocimientos previos es necesario tomarla en consideración dentro de la educación formal.

Postlewaite, Elizabeth M.

Strand D

Tuesday, April 2, 1996
4:00 pm — 5:00 pm
Regency C

Practicing Teachers' Perceptions of Undergraduate Preparation for Teaching Science: A Survey of 203 Maine Teachers

Herman G. Weller

National education reform movements are challenging educators to evaluate all aspects of the educational process and, if necessary, to make changes to meet the demands of today's world. Preservice science education is one of many educational processes being evaluated in these reform movements. Across the U.S. and Canada, there has been only a small number of proposals for the redesign of science teacher preparation that have been accompanied by significant feedback from current teachers. Without considering input from current teachers of science in the present discussion of reform, those instrumental in reforming science teacher preparation are omitting feedback from an important component of the educational delivery system. We surveyed current teachers of science in Maine by mail for their perceptions of the effectiveness of their undergraduate preservice preparation and recommendations for improvement of preservice education. A random sample of 397 teachers of science was contacted, with 203 responding, from the Maine Department of Education list of 1993 teachers of science. Both closed and open questions were used to assess the teachers' overall perceptions of their education for teaching science, and the following components: teaching methods of their science content instructors, teaching techniques taught by their education instructors, and content aspects of the science courses.

Powell, Kathryn

Strand H

Tuesday, April 2, 1996
2:30 pm — 3:30 pm
Regency C

Preservice Science Teacher Perceptions of the Nature of Science and the Possible Sources

Diane Adoue

The purpose of this study was to examine the emergent themes from the explicitly stated perceptions of preservice science teachers about the nature of science and to compare those to the understandings of the nature of science proposed in Project 2061. Two groups of participants in science methods courses prepared a paper on their understanding of the nature of science. Those papers were content analyzed and categorized. Results indicated that the methods of science were dominant in students' understanding. Science knowledge understandings were in opposition to the stance taken by national reform efforts. Significant gaps in the understanding of preservice teachers about the nature of science that may well impact their decisions on curriculum and content are troubling.

Powell, Richard R.

Strand D

Monday, April 1, 1996
8:30 am — 10:00 am
Wabash Cannonball

Understanding STS as a Curriculum Framework for Pre-College Science Instruction: A Longitudinal Study of Elementary and Secondary Science Teachers

Michael Robinson Christine Purkiss Kimberly Perry

The purpose of this interpretive study was to explore elementary and secondary teachers' understanding of STS as a curriculum framework for teaching science, and to determine the teachers' willingness to implement a classroom-based STS curriculum. Four elementary teachers and four secondary teachers participated in the study, which occurred over a three year period. The context for the study was an STS inservice teacher education program designed to help teachers understand an STS-related issue of both local and global importance, and to explore ways of implementing this and related issues in their classrooms. Using personal experience methods of data collection and analysis, qualitative data were gathered throughout the study using informal interviews, classroom curriculum documents, formal interviews, interview transcripts, and observations of classroom teaching. During the course of the study four themes emerged that describe teachers' perspectives of STS as a curriculum framework for teaching science: gaining ownership of STS issues; toward classroom implementation of STS; rethinking science content; and constructing a critical consciousness for teaching science. Implications for STS inservice teacher education are drawn and discussed.

Priestley, Holly

Strand D

Monday, April 1, 1996
8:30 am — 10:00 am
Grand D

Impact of Modeled Teacher Enhancement on Instructional Behaviors (7-12)

William J. Priestley

The two studies determined the impact on biology and physical science teaching from longer term modeled teacher professional enhancement activities that gave emphasis to laboratory driven science activities. 2~ urban inservice middle and high school science teachers, who enrolled in an inservice science methodology course, experienced the use of findings from laboratory activities as the driving force for further science instruction. This instructional approach was modeled by the course instructors followed by the teachers, working in small groups to design and teach lesson sequences structured in this way. The researchers were invited by the inservice teachers to videotape pre-laboratory, laboratory and post-laboratory activities in their school classrooms. The teaching was analyzed, using the AMR-STBI, to determine the extent that instruction followed the model. The results indicated that, short term, the modeled approach did result in significant changes in the organization of teaching. The Moore-Sutman Inventory of Science Attitudes used to determine changes in students attitudes about science learning resulting from changes in approach. As expected, no significant changes in attitudes, were determined over the short term. The results were similar for both the biological and physical science teachers.

Pyle, Eric J.

Strand B

Tuesday, April 2, 1996
2:30 pm — 3:30 pm
Regency C

Parallel Courses: Comparison and Convergence of Adolescent Motivational Processes in Informal and Formal Science Education Settings

Studies of adolescent motivation in formal science education (FSE) environments have largely been limited to the administration of generalized expectancy-value (E-V) based questionnaires that attempt to measure motivation towards science without considering the specific context. The E-V basis for motivation can be expanded upon by considering both the antecedents and the consequences of motivational processes. In this study, it was assumed that adolescents in informal science education (ISE) environments were motivated to engage in active science learning. Constructions derived from interviews and observations of adolescents and parents in ISE venues were translated into salient constructs: relatedness-involvement, autonomy-autonomy support, competence-effectance, and situation-specificity. A vignette-based questionnaire developed from these constructs was administered to 45 adolescents in five ISE sites. Next, areas of convergence with respect to the motivational constructs were sought between the ISE venues and FSE environments where the teachers had developed motivational instructional approaches, using the questionnaire administered in the ISE locations. The results of the administration to 95 adolescents in FSE environments were nearly identical on all six constructs. Further investigations will determine if the constructs represented by this convergence are malleable or general to adolescents regardless of their instructional environment.

Radford, David L.

Strand D **Sunday, March 31, 1996**
7:00 pm — 8:30 pm
Illinois Central

Experiencing Scientific Inquiry and Pedagogy: A Model for Inservice Training for Science Education Reform

Linda L. Ramsey

This study was designed to investigate the effect on teachers and their students of a model of professional development that immerses teachers in scientific inquiry appropriate to their classrooms while modeling the use of reform-based pedagogical strategies for teaching science. The course was designed and team taught as a collaborative effort between scientists and science educators. Quantitative data were collected on teachers' pre and post course science content knowledge, attitudes towards science, and science process skills. Quantitative data on the process skills and attitudes toward science of students of project participants and matched groups of students of non-project participants were collected and compared. Qualitative data from open-ended questionnaires, journals, and learning logs were collected from both students and teachers. The program was found to have a statistically significant impact on teachers, their classrooms, and their students. It is recommended that future science professional development projects incorporate collaboration between scientists and science educators. These collaborative efforts should focus on integrating scientific investigations designed and carried out by participants with appropriate pedagogical models for incorporating inquiry-based learning in the classroom.

Raghavan, Kalyami

Strand G **Monday, April 1, 1996**
8:30 am — 10:00 am
Frisco

MARS: A Computer-Supported Middle School Science Curriculum to Foster Model Based Analytical Reasoning

Robert Glaser **Mary Sartoris**

National projects working to reform science education recommend that elementary science instruction center around a few overarching "big ideas" and that students learn to think and to build understanding in the course of their education. Model-based reasoning is an explicit theme in these recommendations. The MARS (Model-Based Analysis and Reasoning in Science) project, in close synchrony with this perspective, has been involved in the development, implementation, and evaluation of a computer-supported, model-centered science curriculum for middle-school students. The curriculum focuses on a hierarchy of concepts needed to understand such fundamental ideas in science as volume, mass, equilibrium, and balance of forces, and to apply this understanding to different contexts - in particular, to explain why objects float and sink. Students progressively improved in their analytical reasoning processes and concept understanding during the implementation. An interview with twelve MARS students of varying abilities was conducted one year after the implementation of the curriculum in a local school. The interview protocol is analyzed to determine the effectiveness of a model-centered instruction in imparting sustainable conceptual understanding, in particular, their application of the concepts of equilibrium and balance of forces in different contexts, and model-based reasoning skills.

Raubenheimer, Dianne

Strand D **Monday, April 1, 1996**
8:30 am — 10:00 am
Jeffersonian

Approaches to The Provision of Classroom Based Support for Teachers

Nkosinathi Mhlongo **Stephen Harvey**

The Primary Science Programme (PSP) is a non-governmental organization which was established in 1983 in South Africa, to provide inservice education for primary science teachers. PSP has adopted a set of values which emphasize collaborative approaches to the inservice education of teachers. Some of these approaches will be described. An attempt is made to translate the values into all aspects of the organization's practice, including the work of the curriculum development unit (CDU). The results of a survey to assess the extent to which this has been achieved will be reported and some problems highlighted. One focus within the CDU is the provision of classroom based support for teachers. A working group has developed and researched some approaches. Two different approaches which involve participating teachers in examining classroom issues will be discussed. The first involves teachers in action research and reflection. The second involves teachers in developing 'shared observation criteria' and observation schedules. These schedules are used during lesson observation and for reflective purposes. Some results from each approach will be described. Broader issues relating to inservice education in South Africa will be discussed.

Reinhold, Peter **Strand D** **Monday, April 1, 1996**
10:30 am — 12:00 pm
Illinois Central

Case Studies on Teachers' Reflective Practice within the Developmental Research Project PING

The German PING Project is a pilot project of the Federal and the State Commission for Educational Planning, where teachers, inservice-trainers, and researchers are cooperating to establish a practice of integrated science education (PING). Together we are developing a conceptional framework, teaching-material for integrated science education and a structure of cooperation that guides us in a common and shared practice.To ensure a reflexive development and reasoned actions (Aizen) we are using research that informs us about the effects and conditions of our development. Within this process, reflective practice (Zeichner) is an essential structural element. It is related to the teachers as well to the researchers and constitutes their cooperation. How this reflective practice can be structured, what types of instruments are useful to induce reflection and how this reflection affects the understanding and application of PING is investigated in a qualitative and participatory case study with six teachers each teaching five different PING units The paper presents findings from a questionnaire and related in-depth interviews with these teachers at the beginning and end of each unit.

Rennie, Léonie J. **Strand F** **Monday, April 1, 1996**
1:00 pm — 2:30 pm
Grand F

The Construction of Gender in Single-Sex and Mixed-Sex Classrooms

Lesley H. Parker

This study compares males' and females' perceptions of the learning environments in single-sex and mixed-sex science classrooms. Over 700 students in five high schools gave their views of the nature of their participation and interaction in their science classrooms, and additional data were obtained from their teachers. There was congruence between students' and teachers' perceptions of the environment in the two kinds of classrooms. The results indicate that females perceived that in their mixed-sex classes they participated less, and had less interaction with the teacher, for both instructional and non-instructional purposes. Females received less support and more harassment from other students in mixed-sex classrooms than they did when in single-sex classes. Conversely, males' perceptions of classroom life were very similar for mixed-sex and single-sex situations. However, males seemed to perceive most "hassle" in single-sex classes, whereas females perceived the least in single-sex classes. The single-sex environment provided opportunities for teachers to address apparent shortcomings in males' and females' level of skills, which, when effectively addressed, resulted in improved attitudes and performance.

Reyes-Herrera, Lilia **Strand B** **Monday, April 1, 1996**
1:00 pm — 2:30 pm
Wabash Cannonball

Culture as Context in the Teaching of Science

The issues of culture and context in the teaching of science have been neglected in the research and practice of science education. The theme of the conference this year "Science Education for the 21st Century: Creating a Culture for Collaboration" might be interpreted as a call for interpreting culture in the teaching and learning of science. In this way creating a culture is creating a context. A culture for collaboration between educational researchers, teachers and students might help to make a difference in the science classroom. This study aims to interpret the construction of the teaching context from the point of view of a science teacher while enacting an ecology curriculum for sixth graders. The methodology was interpretive research guided by the constructivist paradigm. Two issues of powerful educational significance are evident from this research: 1.-The degree of coherence between culture and context is associated with the relevance teacher and students give to the science topic. 2.- The culture created by teacher and students' daily lives has great significance in the teaching process and students' understanding. Evidence for these findings is supported by the different sources of data of this research. These findings represent a definite incentive for alternative considerations in the teaching and learning of science in the classroom.

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Rice, Diana C.

Strand B **Tuesday, April 2, 1996**
2:30 pm — 3:30 pm
Regency C

Using Children's Trade Books to Teach Science: Boon or Boondoggle?

Ann D. Rainsford

This study was guided by the question, What is the role of children's literature, specifically fantasy and realistic fiction, in the development of children's ideas in science? Over 100 children's trade books were examined by two researchers, one a science educator and the other a specialist in children's literature, using content analysis. Results show that many science concepts, both correct and incorrect, are conveyed overtly or may be inferred in both types of books examined. Many of the science topics appearing in both types o books parallel concepts studied in the research on "children's science." Implications for science teaching and recommendations for future research are discussed.

Richardson, Lon

Strand H **Monday, April 1, 1996**
4:00 pm — 5:30 pm
New York Central

Preservice Teacher Reflections on their Personal Experience in a Democratic / Brain-Based Educational Environment

Using the theoretical frameworks of: Democratic Classrooms (Apple & Beane, 1995), Neurobiology of Learning (Caine & Caine, 1994; Edelman, 1992), Socially Situated Learning (Bowers & Flinders, 1990; Light & Butterworth, 1992), and Social Organizational Theory (Weick, 1979), an elementary science methods classroom was restructured to incorporate the propositions shared by these frameworks. The educational environment established was hypothesized to influence learning positively, to challenge student pedagogical values, and to alter these values to make them coherent and consistent with research. Student pedagogical philosophies and were gathered at the beginning and at the end of the course. Results indicated that student learning was greatly enhanced, learning was perceived to be of a more personal nature and for the benefit of the students, the feelings of safety this environment elicited allowed students to be risk-takers and to question-deconstruct-reconstruct their values and those of society, and as students began to recognize relationships they were able to transport educational issues from the economic-political arena to the socio-ethical arena where they could be critically analyzed in terms of human impact.

Riley, Dana

Strand J **Tuesday, April 2, 1996**
4:00 pm — 5:00 pm
Regency C

How is Science Presented and Interpreted at a Natural History Museum?

This interpretive study explores how a museum staff believes science is presented and how museum visitors interpret it. Ten staff members of various roles at a midwest museum of natural history were interviewed regarding their beliefs about science, science education, the role of their museum, and how science is represented in their museum. Corresponding interviews were conducted with 10 upper primary students who visited the museum with different school groups. The students' populations ranged from urban, suburban, to rural. Students were interviewed prior to and after their visit as well as asked to carry micro cassettes with them during their visit to record "events of interest." All interviews were transcribed and coded. Current results indicate staff members' descriptions of science to be either a type of process or a set of facts, similarly, such beliefs influenced how they understood science to be represented at their museum. As student interviews become coded, it is hoped that by comparing the staff and student interviews, points of commonality and conflict will emerge which can be used by the museum staff to clarify how visitors may be constructing interpretations of science through a museum visit.

Riley, Joseph P.

Strand E **Monday, April 1, 1996**
10:30 am — 12:00 pm
Regency B

Does a Science Leadership Program Make a Difference?

Lena Lane

Science education leadership programs hold promise of providing cost effective means of communicating science education reform to the classroom. The goal of these programs is to prepare classroom teachers to conduct science inservice programs in their schools and districts. The traditional "outside in" model of staff development has perpetrated a paternalistic system that reinforces "schooling as usual". The program evaluated in the present study makes use of an "inside" model through a teacher to teacher approach to professional development. The program provides leadership training for elementary, middle and secondary science teachers interested in sharing their classroom experience and specialized training with colleagues. Participants completing the training conduct elementary science workshops throughout the state. This evaluation study reviews participant concerns, expectations, and attitudes on entering the program, at the end of the program and half way through the first year. The PACE model complements other more traditional evaluation strategies and allows the evaluation to reflect the "inside" nature of the program.

Rillero, Peter

Strand B **Sunday, March 31, 1996**
7:00 pm — 8:30 pm
Grand B

Preservice Elementary School Teachers' Views of Nature and the Natural World

William W. Cobern

An individual's views of nature may have a profound effect on their learning of science and their teaching of science. This qualitative study investigated preservice elementary school teachers' views of nature and the natural world using a three part interview. Elicitation devices provided rich data from the interviewees. The interviews were transcribed, entered into Ethnographer, and subjected to content analysis. From the analysis of the interviews, concept maps of the preservice teacher's views of nature are being developed. From the interviews and concept maps, narratives on the preservice teacher beliefs are being developed. Assertions from the study will be developed and scrutinized. These assertions will be compared to similar studies involving nursing students and high school students.

Rivard, Leonard P.

Strand B **Monday, April 1, 1996**
1:00 pm — 2:30 pm
Grand E

The Effect of Talk and Writing, Alone and Combined, on Learning in Science: An Exploratory Study

Stanley B. Straw

The purpose of this study was to investigate the role of talk and writing, alone and combined, on learning in science. The 43 eighth-grade students were randomly assigned to four groups, all stratified for gender and ability. The talk-only group discussed the problem tasks in peer groups. These tasks involved explaining everyday events which apply ecological concepts. Students in the writing-only group wrote explanations but without prior discussion. Students in the combined talk and writing group discussed the problems with peers prior to writing their explanations. The control group completed simple learning tasks during these sessions. The independent variables included treatment, gender and ability. Dependent variables included knowledge scores based on multiple choice tests, essay questions, and concept maps at three times during the study (pretest , immediate posttest and delayed posttest). In addition, some of the discussions were analyzed to determine how student understanding evolved in these peer groups. The findings suggest that peer discussion is an important mechanism by which students construct knowledge. Furthermore, discussion combined with writing appears to enhance the retention of science learning over time. Moreover, gender and ability may be important mediating variables that determine the effectiveness of talk and writing for enhancing learning.

Robinson, Scott **Strand F** **Tuesday, April 2, 1996**
2:30 pm — 3:30 pm
Regency C

Stories of a Female Learner in a High School Physics Classroom: Caring, Connectedness, and Voice

The purpose of this interpretive case study is to describe caring, connectedness, and voice as it relates to the learning of physics by a female student in a high school classroom. Specifically, what sense does the student make of her interactions with the male physics teacher? This research is part of a larger dissertation project designed to investigate student understanding of mechanics, classroom ethics, and gender. The qualities of the student-teacher interactions are interpreted from 95 hours of classroom observations and 20 hours of transcribed interviews with the student. Her perceived and preferred classroom experiences are presented in two stories. The student-teacher interactions are analyzed in light of the feminist literature relating to caring, connectedness, and voice. Significant findings are; (1), the female learner has a desire to enter into a caring relationship with the teacher; (2), the teacher's sarcastic humor in the classroom constrain her connectedness with him; (3), the student comes to a better understanding of physics concepts through class discussions in which her voice is valued; and (4), multiple instructional strategies enable the student to enter into an array of caring relationships which enhance her learning of physics.

Rodriguez, Alberto J. **Strand E** **Sunday, March 31, 1996**
8:30 pm — 10:00 pm
Regency A, B, C

Evidence of Change in Student Achievement: An Analysis of State Wide Systemic Reform Initiatives

This paper provides a critical analysis of the evidence of change in student achievement as a result of the NSF funded Statewide Systemic Initiatives (SSI) Program. I report on the nature and level of change in student achievement across grades, gender, ethnic background and socioeconomic status.

Roempler, Kimberly S. **Strand D** **Tuesday, April 2, 1996**
4:00 pm — 5:00 pm
Regency C

A Study of Science Teacher Leaders' Changing Concerns Regarding the Use of Portfolio Assessment

This study used the Stages of Concern dimension of the Concerns-Based Adoption Model (CBAM) to characterize science teacher leaders' (n=23) concerns when asked to use portfolio assessment both before and after participating in a series of six workshops on portfolio assessment. An indication of the effectiveness of the workshops was provided by analyzing the changes in concern levels, pre- and posttest, for the seven subscales of the Stages of Concern Questionnaire (SoCQ). The responses of the science teacher leaders' were also compared to that of a volunteer control group of teachers (n=18). The changes in levels of concerns for the treatment and volunteer control groups combined seem to be related to teaching experience, use of portfolio assessment, and involvement in other innovations. The results of this study indicate that using the CBAM procedures to monitor teachers' concern levels and develop professional development opportunities can result in the lowering of teachers' Informational, Personal, and perhaps Management concerns about the implementation of an innovation while at the same time increasing the intensity of Collaboration and Refocusing concerns.

Rogers, Laura N. **Strand D** **Tuesday, April 2, 1996**
8:30 am — 10:00 am
Grand C

Negotiating Reform-Directed Change Among Preservice Students, Cooperating, Teachers and University Science Educators

The objectives of this study were to (a) identify and describe variables involved in reform-directed science teaching and (b) facilitate implementation of reform-directed science teaching among student teachers, cooperating teachers, and university science educators. The study took place within a two-semester sequence of secondary science methods course and a student teaching practicum designed to (a) coordinate with recommendations of national and state science education organizations and (b) provide an environment for change. Videotaped flexible protocol interviews, a survey of metaphor and professional skills, and course assignments (journal entries, course exams, school-site tasks) were periodically given to encourage reflective thinking among the preservice teachers. The greatest change toward reform-directed teaching was made by the student teachers who were least likely to be at risk by implementing those changes. The student teacher's beliefs about the nature of the learner determined willingness to work to implement reform-directed teaching. The student teachers who did not value their students' own construction of knowledge did not tend to provide opportunities for that construction.

Rogg, Steve

Strand C **Monday, April 1, 1996**
8:30 am — 10:00 am
Missouri Pacific

The Landscape Instrument Set: Painting the Panorama of the Landscape

Bill Boone **Arta Damnjanovic**

This paper discusses the design and revision of instruments as well as the collection of data intended to describe the impact of a statewide systemic initiative. The authors will describe the complex and extensive nature of the assessment, including the development, testing and revision of six questionnaires. The random selection process of using 126 schools in which the principals and all science and mathematics teachers is discussed. The questionnaire items focused on classroom instruction, administrative support, parent as well as peer influences, and issues of school change. Item response theory was used to evaluate the validity and reliability of the items as well as the functioning of the scales. For scales which defined a unidimensional variable, item response theory was also used to help define item calibrations on a logit scale for each instrument. This calibration step enabled an invariant scale to be defined. Mean attitudinal measures were calculated for each respondent and used in subsequent analysis using parametric tests (t-tests, ANOVA's, etc.,). Findings from these tests are discussed.

Rojas de Astudillo, Luisa

Strand A **Monday, April 1, 1996**
1:00 pm — 2:30 pm
Grand D

Understanding Alternative Conceptions in Chemistry: A Neo-Piagetian Explanatory Model

Mansoor Niaz

The objective of this study was to establish a relationship between student performance on a test of alternative conceptions in chemistry and the cognitive variables postulated by Pascual-Leone's theory of constructive operators. Eighty-five science major freshman students (Ss) were tested to determine the following: alternative conceptions, formal reasoning (GALT), mental capacity (M), 'learning-to-learn' ability (L), and cognitive style (GEFT). Results obtained show that Ss had at least two alternative conceptions in each of the 8 items in the test. Multiple regression analysis showed that 25% of the variance in performance on the total score of alternative conceptions was explained by GALT ($F = 12.44$; $p < .001$) and L ($F = 4.47$; $p < .01$). These results have important educational implications in view of recent developments in the neo-Piagetian framework. For example, a student may activate all the relevant executive schemes required to solve a problem (extensive aspect of cognition) and yet may not solve the problem correctly as it requires the interaction among various cognitive variables and alternative conceptions (intensive aspect).

Ron, Salit

Strand B **Tuesday, April 2, 1996**
2:30 pm — 3:30 pm
Regency C

Do Peer Tutors Achieve Higher Academic Achievement than Their Tutees While Learning Evolution in a Cooperative Mode?

Reuven Lazarowitz

The Cooperative learning approach promotes peer interaction as a way to facilitate cognitive construction of the knowledge. One aspect of peer interaction is peer tutoring in which each learner serves as a teacher. The purpose of this study was to find out if differences exist in achievement between "peer tutors" and their tutees. The sample consisted of 121 students from seven 11th and 12th grade classes. The students learned evolution by the Jigsaw method during 4 weeks. Each class was divided into heterogeneous groups of 4 members by previous achievement and gender. The topic was divided into 4 sub-topics and each student was assigned one of the 4 sub-topics according to his/her learning ability. Students with the same sub-topic formed "expert" homogeneous groups, whose task was to study together their sub-topic and prepare it for peer-tutoring. Then students returned to their heterogeneous group in which every one taught the sub-topic prepared in the expert groups. Each student learned the other 3 sub-topics from the peers. A multiple choice questionnaire on the 4 sub-topics was used to assess students' knowledge. Mean scores were analyzed by sub-topic, peer-tutors, tutees and gender, using a nested design with Wilcoxon matched-pairs signed-ranks test. The results show that "peer - tutors" did not get significant achievements on the sub-topic they taught compared to their tutees. No differences were found for gender with the exception of boys peer tutors identified with high learning ability. This research indicates that both peer-tutors and their tutees gain at the same amount in the cooperative mode of learning.

Ronkin, Jacob

Strand E

Sunday, March 31, 1996
8:30 pm — 10:00 pm
Regency A, B, C

The Development, Implementation and Evaluation of a Curricular Unit on "Interaction of Light and Matter".

Avi Hofstein **Ruth Ben-Zvi** **Ron Naaman**

The problem of relevance is one of the basic problems that science curriculum developers have to solve. An experiment to solve this problem was conducted by the development of a chemistry module, titled "Interaction of Light and Matter". In this module the scientific principles of relevant "real life" phenomena (e.g., operation of microwave oven, fluorescent lamp, TV screen and photosynthesis) are discussed. Within the same framework some parts of the traditional subject matter of spectroscopy were introduced. This module was implemented in 7 classes in 4 high schools in Israel (N=154). The assessment component consisted of both qualitative and quantitative methods. Most of the students found this module interesting and relevant. Several misconceptions were observed and classified. On the basis of the findings from the evaluation phase certain changes in the textbook were made and additional phase of implementation will follow.

Rop, Charles Jay

Strand F

Wednesday, April 3, 1996
10:30 am — 12:00 pm
Grand A

Young Women and Physical Science: The History and Challenge of One Feminist Chemistry Teacher

The purpose of this study is to hear the voice of an exceptional female high school chemistry teacher concerning meaning and action in cultural context. She explains that her personal history with gender-related struggles in academic science inform her present teaching practice. This research examines her perspectives on what it takes to convince young women that they can have a viable future in the physical sciences. Her story raises many questions about issues implicit in feminist perspectives in science, the role of women in science education, and the effects of teaching to encourage more young women to pursue study in physical science. During an ethnographic and interpretive study, the researcher became a participant observer in introductory chemistry classes in a Midwestern public high school during one school year. The teacher was interviewed in informal conversations. Field notes and transcripts were considered primary data sources. Audio tape transcriptions and written artifacts served as secondary sources. The teacher explains that her perspective and approach to chemistry is different than the more typical male perspectives and that an unusually high percentage of her female students go on to further study in physical science.

Roth, Kathleen J.

Strand D

Sunday, March 31, 1996
7:00 pm — 8:30 pm
Grand A

Feminist Perspectives in Science Teacher Education

Angela C. Barton **Lynne Cavazos** **Constanza Hazelwood** **Elaine V. Howes**
Lori Kurth **Margery Osborne** **Gail Richmond**

In this interactive session, presenters will stimulate discussion by sharing autobiographical stories about their use of feminist theories and pedagogies in teacher education. Discussion will be organized around the questions: How can feminist theory and pedagogy inform our teaching of prospective and inservice elementary and secondary teachers as they are learning to teach science? What successes, challenges, and failures have we experienced in experimenting with feminist pedagogies in science teacher education? What kind of research about these feminist explorations in teacher education would be important to contribute to the science education community? Participants will choose to join one of three discussion groups: prospective secondary and elementary science teacher education, inservice science teacher education, and prospective elementary science teacher education. Feminist lenses suggest ways to reconstruct science and science teacher education in ways that are more inclusive, liberatory and critical. The purpose of this session is to begin an ongoing conversation about these alternative perspectives.

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Roth, Wolff-Michael

Strand B **Monday, April 1, 1996**
10:30 am — 12:00 pm
Grand D

The Construction of Knowledge in Traditional High School Physics Laboratories: A Phenomenological Analysis

Cam McRobbie **Keith Lucas** **Sylvie Boutonné**

Traditional school science laboratory activities have recently come under considerable criticism. However, until we focus more sharply on what students actually do, we are unlikely to have a definitive answer to our questions about the pedagogic value of laboratory work. In this study we set out to understand what and how students learn in physics laboratories. We conducted an in-depth interpretive study in a Year 12 Australian high school physics class. We videotaped an entire unit on circular motion with three cameras, collected fieldnotes, students notebooks, and four interviews with eight students and the teacher. We found that some but not all students construct conceptual entities when they engage in traditional laboratory activities. We developed a notational scheme which allows us to represent the situated nature of knowing and learning in labs and the material, social, and individual character of conceptual entities. As a result of this investigation, we understand instructions as ontologically ambiguous and subject to interpretive flexibility. Interpreting just what an instruction means was very difficult. The phenomena and conceptual entities students construct frequently differ from canonical equivalents. We conclude that from a social constructivist approach there are learning opportunities even if the activities are of more traditional nature.

Roth, Wolff-Michael

Strand A **Tuesday, April 2, 1996**
8:30 am — 10:00 am
Grand B

Thinking with Hands, Eyes, and Signs: The Development of Multimedia Science

This study focused on the learning processes involved during a simple machines unit in a grade 6/7 classroom from a socio-linguistic perspective. Results show how understanding emerges from students' and teacher's interactions that make use of multiple modes of communication. To understand the processes by which children developed canonical "conceptual" talk and thinking in science classrooms organized as linguistic communities, the fundamental interdependence of "hands, eyes, and signs" must be accounted for. This study has important implications for the design of technologies that allow larger numbers of students to participate in whole-class sense-making conversations, which, from a socio-linguistic perspective constitutes learning science.

Rowe, Mary B

Strand E **Monday, April 1, 1996**
1:00 pm — 2:30 pm
Regency A

Design and Use of Flexible Search Systems for Curricular Data Bases

Richard McLeod **Emily Girault** **Francis Lawlor** **Sebastian Foti**

The focus in this interactive symposium will be on the conceptualization of search systems for computer based curricular data bases. The need is for search systems that are flexible, instructive, and responsive to thematic as well as particularistic orientations to curriculum. Two such data bases will be described and discussed against the backdrop of eight contending factors related to current reform agendas. The symposium is intended as an invitation to inquiry. The number of such data bases is expected to grow rapidly and they pose serious research and development challenges.

Roychoudhury, Anita

Strand C **Monday, April 1, 1996**
8:30 am — 10:00 am
Missouri Pacific

Close Up View with NUD IST

This paper is part of the study that examines the impact of a statewide systemic initiative (SSI). In this paper, the author Attempts to understand the nature of reforms that are taking place in a select group of the state's schools. To understand the phenomenology of the process, 12 schools were visited for three consecutive days each. During each visit, the mathematics or science teaching of an SSI teacher (one who had participated in a year of professional development) was observed. A thick description of the instruction and the context in which it occurred was constructed from field notes and collected artifacts (curriculum, lesson plans, tests, and so forth) as well as interviews of the teacher, a few students, and the principal. Eighteen initial categories were identified and used with the NUD•IST program to organize the observational and interview data from the 12 schools. Then, the interpretive summary developed from those categories was collapsed to identify factors that were similar for several schools. In addition, the unique features of the instruction or the school environment were reported separately. Two of the major outcomes were 1) a detailed description of the nature of inquiry as provided by the teachers and 2) an understanding of the barriers to, or promoters of, change in schools and communities.

Rua, Melissa

Strand C **Monday, April 1, 1996**
1:00 pm — 2:30 pm
Jeffersonian

Conceptual Change within Vygotsky's Zone of Proximal-Development

M. Gail Jones **Glenda Carter**

The purpose of this study was to investigate how science teachers' knowledge develops in a sociocultural context. Utilizing a case study approach, seven dyads of teachers participating in a conceptual science graduate course worked cooperatively on a series of physical science activities that were designed to promote conceptual growth. Teachers drew a series of pre- and post- instruction concept maps, maintained weekly reflective journals, and developed a professional portfolio. Audiotapes and transcriptions were made of dyad interactions. Analysis of documents were analyzed for evidence of cognitive development. Results showed that conceptual change occurred for both individuals and dyads. Different types of knowledge mediators were identified. These included oral and written language, teachers' students, teachers' peers, physical tools and the course instructor. The data showed that Vygotsky's "more capable peer" is a fluid term, dependent on the learning context.

Rye, James A.

Strand A **Wednesday, April 3, 1996**
10:30 am — 12:00 pm
Grand C

An Exploratory Study of the Concept Map as a Tool to Facilitate The Externalization of Students' Understandings About Global Atmospheric Change in the Interview Setting

Pete Rubba

The main purpose of the study was to investigate the effectiveness of two different types of concept interviews as means for eliciting students' post-instructional understandings about global atmospheric change (GAC). The interviews differed in that one embedded a concept mapping process (POSTIMCI) and the other did not (POSTICCI). A chief criterion measure was "accordance:" the degree to which students held the ideal post-instructional understanding set forth in a teacher-expert concept map. After GAC instruction that included concept mapping activities, 34 eighth grade science students were assigned randomly to and completed either POSTIMCI or POSTICCI. These students and their teacher also completed relatedness ratings of central concepts from the teacher-expert concept map. Ratings were transformed to Pathfinder Networks, which were compared to yield a student to teacher similarity index (PFNCSI). Regression analysis revealed that "type of interview" did not predict accordance. However, most POSTIMCI students perceived the concept mapping interview component to be helpful and affect positively their answers to the interview questions. These perceptions did not correlate to gender or ability level. PFNCSI did predict (p =.003) accordance--PFNCSI was a reliable confirmatory measure of the degree to which students held the ideal post-instructional understanding.

Sanders, Jo **Strand D** **Monday, April 1, 1996**
4:00 pm — 5:30 pm
Regency C

Institutionalizing Gender Equity in Preservice Teacher Education

This study sought to determine if teacher educators who did not include gender equity in their science, mathematics, and technology methods courses, could do so effectively with assistance and support. The change model used with 61 teacher educators nationwide called for the provision of extensive materials, in-depth instruction, and intensive followup, and actively encouraged local variations. Results indicate that most participants exceeded performance expectations. My paper analyzes the factors which, in my opinion, account for the results.

Saturnelli, Annette **Strand D** **Monday, April 1, 1996**
4:00 pm — 5:30 pm
Grand B

Implementing a Multicultural Science Education Program in a School District

This study examined the impact of a staff development program on participants of a four-week NSF/Texaco-funded Summer Science Camp (SSC). The 60-hour program addressed strategies for teaching science in an urban multicultural setting, new knowledge regarding high technology microscopy equipment, and the use of technology to access information. Participants were 60 7th graders ; 12 high school students; and 9 teachers . Minority and nonminority scientists and engineers visited camp regularly. Visits to their lab/industries followed. Parent meetings were held the week before camp and at the close of camp. Students completed problem-solving projects and were engaged in two science olympiads. The following data was collected and analyzed: attendance records of all participants; daily journals of all participants; a Students Self-Concept Scale (pre- and post-camp); video-tapes and photographs taken throughout the program. Results indicate a positive impact on all participant groups. Evaluation of SSC '95 will be used to improve SSC '96 . During the '95-'96 school year the SSC teachers will serve as instructors in a districtwide inservice program.

Scantlebury, Kathryn **Strand F** **Monday, April 1, 1996**
1:00 pm — 2:30 pm
Grand F

Two Different Worlds: Girls' and Boys' Perspectives and Preferences of the Science Classroom

This paper discusses the results of a classroom environment scale developed to ascertain students' perceptions of gender equity in their science classrooms. The data set was divided by gender and two factor analyses were completed. The first used the student as the unit of analysis, the second used class means. Different items loaded on the 'actual' and 'preferred' scales for male and female students. Although the reliabilities of the factors were acceptable, the contrasting results made interpretation of the scales difficult. Effect sizes for each item were calculated. Significant differences in the effect sizes for male and females students were found on items in the 'actual' and 'preferred' scales. Small to large These results may indicate that the science classroom environment may not reflect what female students would prefer. Also, the results of the factor analysis suggest that researchers using classroom environment scales should analyze their scales by gender, prior to discussing gender differences on the scales.

Scantlebury, Kathryn **Strand F** **Tuesday, April 2, 1996**
8:30 am — 10:00 am
Grand A

"It's Really Nice to Work With Young People": Is Science Teaching "Women's True Profession"?

William J. Letts, IV **Bambi L. Bailey**

In this symposium, the authors challenge contradictory assumptions about science teaching and gender, arguing that history and philosophy of teaching no less than history and philosophy of science must inform the reconstruction of science teaching with a sensitivity to gender. After providing an historical account of the interaction of science teacher education with issues of gender, they use qualitative data from interviews with eighteen science teachers of both sexes to evaluate the possible applicability to science teaching of Laird's philosophical analysis of Beecher's slogan which popularized teaching as "woman's true profession" (Laird, 1988a). They examine issues of power and control for female teachers in the classroom, as well as the apparent gendered contradiction that seems to exist for teachers working in a profession that is feminized and a subject area that is masculinized. They make recommendations for the practice of science teacher education and for further gender-sensitive research reconceptualizing the task and achievement of science teaching.

Schaller, John **Strand C** **Monday, April 1, 1996**
4:00 pm — 5:30 pm
Missouri Pacific

A Mirror for Reflection: Working with Science Interns

This research represents an autobiographical case study of my experiences as a cooperating teacher. My purpose for this work is to chronicle an evolution of metaphor in my teaching practice and to document the effect on the implemented curriculum. This is a story of my work as a cooperating teacher with two student interns whose experiences and questions served as catalysts for my change process. The interns provided a "mirror for reflection" on my practice thus promoting a "re-viewing" of my life history and a reevaluation of my beliefs on teaching and learning. The Reflective Cooperating Teacher Model is introduced in this work which facilitated my reconceptualization of previously unknown interests and beliefs through the construction and analysis of narrative. Several thematic patterns were explored including the influence of role models in education, the importance of having a passion for one's discipline, and the influence of stress on the development of survival strategies in teaching and learning. Constructivist theory was applied in the understanding and resolution of these issues which facilitated a reconstruction of my environmental education curriculum to one that is driven by authentic science practice.

Scharmann, Lawrence C. **Strand D** **Monday, April 1, 1996**
1:00 pm — 2:30 pm
Burlington Route

Preservice Secondary Science Teachers' Orientations Toward Science-Technology-Society (STS) Instruction

M. Gail Shroyer **Cherin Lee**

Action research was conducted over five years in a secondary science teacher preparatory program. The purpose of this research was to maximize the effectiveness of a methods sequence relative to the enhanced adoption of social/personal instructional strategies during student teaching. During the first two years of the project, not one student teacher (n=48) adopted peer discussion as a social/personal instructional approach. During the final two years, nearly 40% (14 of 36) reported extensive use of peer discussions. Through the analysis of a variety of data sources, the following conclusions were offered: (a) social/personal instructional strategies need to emphasized and expertly modelled in science teacher preparatory programs; (b) cooperative/collaborative learning should be constructively arranged to take advantage of the different perspective-taking abilities of both genders; (c) STS themes used in methods class should permit input and expertise from diverse science disciplines; and (d) staff development with inservice (cooperating) teachers using a professional development school model is a necessity. If inservice (cooperating) teachers have a direct role in the professional development of preservice teachers, ownership for an unfamiliar yet powerful instructional strategy will be more easily accomplished if it is experienced concurrently with their student teachers.

Schmidt, Hans-Jürgen **Strand A** **Monday, April 1, 1996**
4:00 pm — 5:30 pm
Wabash Cannonball

Students' Understanding of Molecular Structure and Properties of Organic Compounds

The purpose of the study was to investigate senior high school students' difficulties predicting the relative boiling points of alkanes, to investigate students' difficulties predicting the existence of hydrogen bridge bonds between organic molecules, and to develop test questions that enable teachers to quickly get information about their students' difficulties. Fourteen free-response and multiple-choice questions were administered to 4,963 senior high school students. Students were not only asked to tick the answer they regarded as correct but also to give reason for their choice. Results indicate that students' understanding of intermolecular forces is not precise enough. Students have difficulties predicting the relative boiling points of unbranched and branched alkanes. They also have difficulties predicting hydrogen bridge bonds between molecules with which they were not familiar from chemistry lessons.

Schmidt, Julie

Strand H

Monday, April 1, 1996
8:30 am — 10:00 am
New York Central

Fourth Graders Explore the Relationship Between Science and Technology: Identity Construction Traverses the Scientific Landscape

In this case study, fourth grade students from a desegregated, urban school explored several components of "the nature of science." This paper analyzes the instruction, teaching, assessment, and learning from a three-week unit on fossils where 26 students studied the relationship between science and technology. Most of the prior related research has focused on either science teachers' ideas and beliefs about the nature of science or on secondary students' understandings. Building on Shapiro's (1994) and Solomon's (1990) work, this research examined young students' developing ideas about the nature of science, scientific discovery, the connection between evidence and persuasive argument, and the connections between science and technology. The analysis suggests that students of this age are capable of and interested in exploring these issues; further, these students have a "personal stake" in particular aspects of scientific discovery that link to their developmental process of forming an identity. In addition, our analysis suggests that these "identities" are embedded in larger, socio-cultural contexts, such as social class, which influence the way that children ultimately construct an understanding of the relationship between science and technology. Students' written and oral performance-based assessment indicates that this topic is appropriate, possible, and significant to their lives.

Schmuckler, Joseph S.

Strand D

Monday, April 1, 1996
8:30 am — 10:00 am
Grand D

Meta-Analyses of Learning from Laboratory Based Experiences (9-14)

Susan Rubin **Mulian Zhou**

The meta-analyses analyzed results of 110 earlier studies (1970-1994) that examined the learning outcomes of traditional and various non-tradition approaches to science laboratory-based instruction at the 9-12 and 1~14 levels. Studies chosen for these meta- analyses met four criteria: appropriate time period, included valid statistical data, used a control group, and included an appropriate student population. The analyses followed the established methodology by Hedges (1989), in that individual and combined or weighted effect sizes were determined, and p values were established. The following are major conclusions: The non-traditional approach to laboratory component of science instruction, when compared ~o the traditional approach, results in: ~1) significantly improved content learning, reasoning ability)~, improved attitudes toward science and/or scientists and Improvement in laboratory manipulative skills only at the 1~14 level; (~) significantly improved cognitive and non cognitive student learning in both the biological and non-biological sciences. (3) significantly improved cognitive and non-cognitive student learning when various non-traditional teaching materials and strategies were employed, such as technologies, instructional strategies labeled inquiry-discovery, learning cycle fommat, independent laboratory, and various organizational approaches that considered students' characteristics.

Schnipper, Linda

Strand D

Tuesday, April 2, 1996
2:30 PM — 3:30 PM
Regency C

Analysis of the Effectiveness of Inservice Education in Promoting Teacher Change and Educational Reform

Joanne Tims

The objective of this paper is to increase understanding of how teachers become agents of change in their own district. Inservice education was provided to Resource Teacher teams, who participated in a four week institute at Miami University preparing 40 hour professional development workshops to help other teachers in their districts infuse inquiry teaching/learning in their classrooms. Teachers who participated in the Resource Teacher Institute had all previously participated in content based six week summer institutes in physics, life science and mathematics at Project Discovery. This research is significant because it demonstrates how teachers become more central in the process of reform, how to professionally develop Resource Teachers to prepare them to become agents of change, and it represents an innovative approach to systemic reform. As a result of the Resource Teacher Institute, teachers felt more prepared to help other teachers, were more aware of state and national standards, and felt more personal professional preparedness. Also, many of the Resource Teacher teams included in their own professional development workshops, activities that had been presented to them during the Institute, and rated many of the activities conducted during the Institute as either valuable or very valuable.

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Scholer, Anne-Marie

Strand F **Tuesday, April 2, 1996**
4:00 pm — 5:00 pm
Grand A

A College Biology Unit on the Genetic Basis of Evolution, Incorportating a Historical Female Scientist and Current Social Applications

The purpose of this study is to analyze the responses of college students to a biology unit which incorporates a relatively abstract concept with relevant current issues, and with a relevant female scientist from the historical record. The sample consisted of 13 psychology students enrolled in a course on research methods. The unit consisted of a lecture on the genetic basis of evolution, a discussion of the ethics of medical research, and an assigned reading of a biographical essay on Louise Pearce, M.D. The students kept journals for four weeks, the unit occurring on the third of those weeks. When assigning a gender to science, all of the students based their opinion on the gender of those who practiced science, or on those portrayed by the media as practicing science. Actual opinions and opinion change must be considered confounded because several of the students reported trying to figure the hypothesis and alter the results. The majority of the students had difficulty recalling a historical scientist. However, after the unit, the majority could relate historical events in science with current concerns such as AIDS. The majority of the students expressed interest in the assigned biographical reading.

Schoon, Kenneth J.

Strand A **Tuesday, April 2, 1996**
4:00 pm — 5:00 pm
Grand C

Attitudes and Alternative Conceptions of Science Held by Preservice Elementary Teachers

William J. Boone

The purpose of this study to was to determine the relationship between attitudes towards science and science teaching held by preservice science teachers and their holding of alternative conceptions of science. Participants (n=619) were upper-level undergraduate students who had not yet begun their student teaching practicum. The instrument created for this study consisted of two sections. The first section was adapted from Enochs' and Riggs' Self Efficacy Belief Instrument. The second section was a test for common alternative conceptions of science created by the authors. The survey was given during the first few weeks of the semester of science methods class at campuses in Rhode Island, Pennsylvania, Florida, Indiana, Arkansas, Kentucky, and North Dakota. Mean attitudinal measures were calculated for the entire self efficacy scale as well as two subscales (outcome expectancy and personal science teaching efficacy belief). The mean attitudinal measures for those correctly answering each content item were compared to the mean attitudinal measures for those selecting each common alternative conception.

Schroeder, Patricia

Strand A **Monday, April 1, 1996**
1:00 pm — 2:30 pm
Grand D

College Chemistry Students: An Examination of Their Knowledge of Fundamental Concepts and Uses of Argument

John Staver

This study examined characteristics of beginning college chemistry students and their conceptual understanding in the fundamental areas of physical and chemical change and of heat and temperature. Pre and post tests containing multiple choice and open ended questions were used. Structured classroom activities in each content area were carried out by dyads; students working individually served as a control group. Data were triangulated by audiotaping dyad interactions and post-activity interviews with individual students. Significant relationships were observed for logical thinking skills with both previous chemistry knowledge and GPA. Pretest scores correlated significantly with previous knowledge. A wide variety of alternate conceptions were held by students, including a confusion between "property" and "change." Students' use of logical argument was also analyzed. They made little use of logical argument or citation of evidence. Use of logic or reference to evidence did not necessarily result in correct explanations.

Settlage, John

Strand D **Monday, April 1, 1996**
10:30 am — 12:00 pm
Illinois Central

Elementary Teachers' Investigating Their Own Practice: The Evolution of Science Study Groups in an Urban School District

Teacher-led study groups were employed as means of professional development for urban elementary science educators. This study describes the growth and maturation of the study group process. Sixteen elementary teachers were designated by the district as exemplary science instructors. These designees were formed into pairs, provided with training in the study group approach, and given the title of co-facilitator. The lead science teachers from each of the elementary buildings in the school district were placed into study groups based upon their topic preference. The study groups met monthly for two hours after school. The group was guided by the co-facilitators to develop a study question that the members would explore in the context of their own teaching over the subsequent month. Every study group session was attended by a science educator who served as an observer whose major task was to provide feedback and guidance to the co-facilitators. At the monthly meetings, the study group members shared the classroom artifacts that they had collected that addressed the study question. The academic year culminated with a summer institute at which the study groups presented their work to teachers throughout the district.

Shaw, Jr., Edward L.

Strand G **Monday, April 1, 1996**
10:30 am — 12:00 pm
Frisco

Effects of the Use of a Science Interactive Videodisc on the Prediction Ability of Kindergarten Students

Robert L. Doan **Richard L. Daughenbaugh** **Deborah Green**

The purpose of this study was to determine the effectiveness of using an interactive videodisc to evaluate the prediction skills of kindergarten students involved in the "sinkers and floaters" activity. This research project involved the collaboration of Science, Early Childhood, and Media Educators with pre and inservice teachers. The research study involved three treatment groups: hands-on materials only, hands-on materials with the videodisc, and the videodisc only. The 86 kindergartner participants were chosen from several elementary schools, representing various racial and gender mixes, different SES and ability levels, and were randomly assigned to the treatments. Data were analyzed using a one-way ANOVA with the Least Significant Difference (LSD) used for post-hoc analysis. Results indicated no significant differences among the treatment groups. Implications (from the study) indicate that using the interactive videodisc is just as appropriate as the use of hands-on materials only. This could indicate that kindergarten studies can master some concepts, particularly process skills, without the use of hands-on materials exclusively.

She, Hsiao-Ching

Strand F **Tuesday, April 2, 1996**
4:00 pm — 5:00 pm
Grand A

Gender-Related Classroom Interactions and Teachers' Beliefs in Middle School Biology Classes

The purpose of this study is to investigate the biology teacher's belief related to her interaction with different gender students. The classroom observation and interviewing method were used in this study. Results showed that boys answered four times as many teacher-initiated questions as girls did. Boys' call out teacher-initiated questions were 34 times more often than girls. Teacher directed boys to answer more questions than girls did. Regardless gender, most feedback received from teacher were restating answer, clarification, and further question. Only boys received negate feedback, and more comment feedback and no feedback. The biology teacher described boys are more aggressive, creative, and free-minded. Boys response and participate more often than girls did. In general, boys perform better in biology classes. According to the results of both classroom interaction and teacher's belief, we might speculate that teacher's belief do sustain or reinforce the differences between different gender of students' participation.

Shea, Trudy

Strand E **Monday, April 1, 1996**
4:00 pm — 5:30 pm
Regency B

Barriers to Integrating Science, Mathematics, and Technology

Robert L. Fisher

The purpose of this study was to identify the barriers to implementing integrated science, mathematics, and technology in middle school curriculum. Data were collected using author created surveys focused on gathering information about the barriers. The barrier data were collected using the Delphi Technique. At the May, 1993, professional development session, teachers and administrators from all eight pilot sites were asked to list barriers to implementing curriculum integration. From this list, the Systemic Barrier Response Survey, using a Likert Scale, was written to measure the degree to which each barrier existed. A separate scale measured the status of plans to eliminate or ameliorate each barrier. Results indicated that five identified barriers remained constant throughout the entire implementation year: time, existing materials and resources, grading procedures, curriculum content, and teacher attitude.

Shepardson, Daniel P.

Strand C **Tuesday, April 2, 1996**
4:00 pm — 5:00 pm
Regency A

Perspectives on Assessment in Science: Voices from the Field

Paul Adams

The objective of this study was to: Identify the understandings and beliefs science teachers held about their assessment practice. The study was grounded in a socioconstructivist theory that posits that teachers construct their own understandings and beliefs about assessment in science based upon their prior knowledge and experience and within the context of the culture of their school and classroom. The study was qualitative in that it consisted of conducting interviews with teachers on their assessment practice. The interviews were audiotaped and transcribed verbatim, and served as the primary data source. Methods of single and cross-case analytic induction were combined to analyze the data. Based upon the interview data, it may be concluded that these middle level (grades 4-9), science teachers' understood assessment from two perspectives: purpose and motivation. These teachers talk about the purpose of assessment as being for the evaluation of student performance and for the informing of pedagogy. The teachers also talk about assessment as being motivated by pedagogy, content, and/or the learner. Further, the teachers' descriptions of assessment activities may be categorized as either formal and alternative in nature, formal and traditional in format, or as informal approaches.

Sherwood, Robert D.

Strand G **Sunday, March 31, 1996**
8:30 pm — 10:00 pm
Regency A, B, C

The "Scientists in Action" Project: Initial Field Studies and Design Revisions

Cognition and Technology Group at Vanderbilt

The poster session will outline a number of issues related to the development, initial field testing, and revision of a National Science Foundation sponsored middle school science curriculum development project, "Scientists in Action." The poster will be divided into five major segments which will include; (1) some of the issues that have lead the group to the design principles of the project, (2) briefly summarize some of the research studies undertaken to support our work, (3) provide a running demonstration of some of the series materials, (4) indicate revisions to the design principles that were made after initial field testing and (5) indicate plans for completion of the project including additional field testing.

Shipman, Harry L.

Strand A **Monday, April 1, 1996**
1:00 pm — 2:30 pm
Jeffersonian

Mental and Physical Models of the Earth in Space: Achieving Conceptual Change in a College Science Course

Cynthia Cuddy

Constructing physical models of the earth in space is the heart of many constructivist approaches to astronomy teaching. Here we investigate the use of a scale model of the solar system, in which planetary diameters and distances are correctly represented. For example, the sun is a 20-cm (8-inch) sphere and the earth is a 2-mm sphere located 10 meters away. We adapted this activity, described in the literature as one for the elementary school, to a college level science course intended for general audiences. We investigated the success of this strategy through quantitative research (pre- and post-testing and attitude surveys) and qualitative research (individual and group interviews). It works. For example, student performance on a set of questions designed to measure their perception of the size of the solar system improved by 21% (significant well beyond the 0.001 confidence level) as a result of the exercise. The interview results show that using the activity really did challenge students' preconceptions. This research also identifies some general issues which emerge when college teachers adapt activities from the K-12 curriculum. This work has been partly supported by NASA's Astrophysical Grants Supplements for Education program.

Shore, Linda S.

Strand J **Tuesday, April 2, 1996**
4:00 pm — 5:00 pm
Jeffersonian

Developing Gender Equity at Home: The Influence of the Exploratorium "Science at Home" Project on Parental Attitudes, Perceptions, and Behaviors.

This paper reports on results from a longitudinal survey of over 800 parents participating in a twelve month Exploratorium "Science At Home" project. Gender equity research literature suggests that girls are more likely to achieve success in science if their mothers hold positive views of science and engage girls in science related family activities. While parental attitudes and family routines are hard to modify through school programs, this research examines the potential benefits of informal family science programs. The goal of this survey was to assess whether having mothers engage regularly in "hands-on" science activities at home would positively impact their attitudes, perceptions, and participation in other science related activities. A 50 item questionnaire was developed that consisted of multiple choice and Likert scale items. This instrument was administered to participating parents, three times during the course of the project. Responses were analyzed for significant changes over time. Gender differences were also examined. Results indicate that while the project successfully encouraged both mothers and daughters to participate in home science activities, there was relatively little change in the attitudes and perceptions of mothers.

Shroyer, Gail

Strand D **Wednesday, April 3, 1996**
10:30 am — 12:00 pm
Illinois Central

Expertise in Elementary Science Teaching: Evaluating an Innovative Pre-Service Preparation Model

Emmett L. Wright **Susan Kerr** **Dan Kaur Weamer**

The purpose of this study was to examine the development of demonstrated behaviors in terms of expertise in science teaching from a constructivist perspective, for undergraduate students who completed the elementary teacher preparation through the Mathematics, Science and Technology (MST) Project. The MST students were compared to non-MST students in the traditional program. Data sources for this case study were gathered during the student teaching experience and included multiple observations, video taped sessions, lesson plans and notes from conferences. Data were analyzed using the Expert Science Teaching Educational Evaluation Model (ESTEEM) that classifies behavior over a four category developmental continuum from novice to expert stage. Analysis revealed that the MST group compared in the non-MST group consistently scored higher on all rubric categories. The MST student teachers scored an overall rank of 3 (competent teacher stage) the Non-MST student teachers overall rank was less than 2 (advanced beginner stage). In addition, during their first year of teaching the MST teachers employed in-state scored even higher on the ESTEEM rubric (rank of 3.9), approaching the proficient teacher stage.

Shroyer, Gail

Strand C **Sunday, March 31, 1996**
7:00 pm — 8:30 pm
Missouri Pacific

Expertise in Preservice Science Education: An Innovative Approach to Training Elementary Science Educators Year II

Emmett Wright

According to many of the reports, undergraduate teacher preparation programs are the key to reform in science, mathematics, and technology education at both the elementary school and the secondary school levels. During the fall semester of 1990 Kansas State University initiated the development of a major university-wide model, supported in part by a grant from the National Science Foundation., to reform elementary school mathematics, science, and technology preparation based on the above recommendations. A major focus of the project is the creation of a partnership between the College of Arts and Sciences, the College of Education, and the Manhattan-Ogden Pubic Schools, according to guidelines established by the Holmes Group (1986, 1989, and 1990), the Carnegie Forum (1986), and Goodlad (1990). Three professional development schools were created in the public school system as an outcome of this collaborative effort. The professional development schools and the partnership between the university and the public schools serves as a model of the Kansas State University teacher preparation program. Teachers have gone through the program and graduated. Preliminary data indicate that these teachers are superior to other graduates especially in science and mathematics.

Shymansky, James A.

Strand D **Monday, April 1, 1996**
4:00 pm — 5:30 pm
Grand C

Inservice Impact on Teachers' Content Knowledge, Content Pedagogical Knowledge and Perspectives on Science Teaching: The Science Parents-Activities-Literature Project (Science PALs)

John Dunkhase
Jennifer Chidsey
Deborah Dunkhase
Eric Olsen
Leigh Monhardt
Bill Dutton
Laura Henriques
Ibrahim Al-Momani
Jeanne Jones
Becky Monhardt
Gary Varrella
Larry Yore

This interactive session will focus on efforts to effect a system-wide, on-going enhancement program in science for a K-6 teaching staff using a model that capitalizes on teacher interest in the language arts and the involvement of parents. The Science Parents-Activities-Literature (Science PALs) Project is a collaborative teacher enhancement project involving K-6 teachers and consultants from a medium-sized school district and staff from a major university. Presenters and discussants will share research results related to changes in teachers' content knowledge and attitudes and beliefs about science, curriculum planning and how to teach science in a novel, interactive session format. The session will open with a brief overview of the Science PALs model and close with reflections of key project staff. A major portion of the session will be dedicated to round-table discussions of four research studies done in conjunction with the project. A packet containing an overview of the Science PALs project and research reports for each round-table discussion is available at the registration desk. Persons planning on attending this session are advised to read the overview and the specific round-table report of choice prior to the session.

Sickle, Meta Van

Strand D **Monday, April 1, 1996**
10:30 am — 12:00 pm
Jeffersonian

A Longitudinal Study of Secondary Science Teachers: Teachers' Voices on the Relationships Among Knowledge Domains

Carolyn Dickman **Margaret Bogan**

A longitudinal study was conducted at Radford University, Jacksonville State University, and University of Charleston. Case study method was used to facilitate the study of, pre-service through two years of in-service, teacher's knowledge structures as they progressed through the various education programs. Teachers have been studied for two to three years. A discussion of pedagogy, content, and pedagogical content knowledge (PCK) including the PCK model will set the stage for the comparison of aspects of PCK versus the relationships and knowledge domains the teachers voice. Research N design issues and findings will be important aspects of the group discussion. These studies indicate that pre-service teachers develop content and pedagogy knowledge structures and form bridges between the two, but that PCK may be an unrealistic challenge for pre-service and beginning in-service teachers. The first and second year teachers did not name or describe the knowledge domains described in the PCK literature. PCK may become a salient point of experienced teachers' knowledge framework, but the teachers studied did not describe it as a separate knowledge domain.

Simmons, Patricia

Strand D
01/04/96
8:30 AM — 10:00 AM
Regency C

Linking Student Outcomes, Teaching Performance, and Features of Teacher Education Programs

The fourth research question in the Salish I project was: What are the links between student learning outcomes, new teacher performance, and features of teacher preparation programs? The data analysis for this question began by identifying classrooms with the highest and lowest improvement scores on student measures. School culture and learning environment variables were also taken into account when identifying the dichotomy of classes. Variables operating within the new teachers associated with differences in the two kinds of classrooms were identified. The new teacher and student variables were then correlated with teacher preparation program features/experiences. This process resulted in the generation of numerous hypotheses about the relationships among teacher preparation programs (experiences/lack of meaningful and critical experiences), the abilities/performances of new teachers to implement appropriate science teaching practices, and the understanding/learning outcomes of science by students in the new teachers' classrooms. We selected two ends of the spectrum of student learning outcomes ("high" and "low" performance measures) by which to examine the possible correlations among teacher preparation, teacher performance, and student learning. The development of profiles of individual teachers and clusters of teachers from "traditional" undergraduate programs and alternative graduate level programs will be the focus of this session.

Simpson, William D.

Strand E
Sunday, March 31, 1996
8:30 pm — 10:00 pm
Regency A, B, C

The Effects of Using the Learning Cycle to Teach Physiology to Elementary Students in Large and Small School Districts

Ann M. Cavallo

Two-thirds of all school districts in the United States are small and located in rural areas. These schools educate one-third of all school-aged people in this country. Prior research has shown that students attending large schools outperform students attending small schools in areas of intellectual development and science concept understanding. This study examined how well elementary school students from small school districts and elementary school students from large districts learned human physiology from a pedagogical tool known as the learning cycle. Results show that both students from large school districts and small school districts learned concepts effectively from the learning cycle. However, students from the large school districts did outperform the students from the small school districts on an evaluation instrument developed to ascertain student achievement after being taught using a learning cycle over human physiology. Small school students were, however, as effective at transferring knowledge of the learned concept to questions about situations which they had no first hand observations. Intellectual differences, socioeconomic status, previous experience and meaningful learning ability were thought to influence the differences found between students from small school districts and large school districts.

Sirochman, Rudy F.

Strand A
Monday, April 1, 1996
10:30 am — 12:00 pm
Grand D

Physics Concept Construction through Experiment, Drawing, Discussion, and Dialogue

This study evaluated the effectiveness of Socratic Dialogue Initiating (SDI) Labs. These labs are designed to promote conceptual change in introductory college physics students, and are consistent with a constructivist theory of learning. Accordingly, interactive engagement, conceptual conflict, accounting for preconceptions, reduced pace, and Socratic questioning by instructors are all emphasized. An experimental group of 11 participants was studied using a combination of qualitative and quantitative research methods. The qualitative portion included the analysis of videotapes of the lab groups, videotaped interviews, and the completed lab manuals. The quantitative portion of the study involved the Rasch Model statistical analysis of a pre- and post-test, the Force Concept Inventory Exam (FCI). Results of the study supply information for improving the labs and information regarding the value of constructivism in science education. Specific physics concepts posing difficulty for students were found, and changes were suggested. General patterns of problems in the lab, such as poor Socratic dialoguing by instructors were revealed. The study also revealed general patterns of assumptions made by instructors regarding meanings behind the physics terms and phrases used by the students. Advantages with the labs were revealed as well.

Slough, Scott **Strand E** **Tuesday, April 2, 1996**
2:30 pm — 3:30 pm
Wabash Cannonball

Area Under Constructivism: A Pilot Study Using a World Wide Web Home Page to Assess Professional Development

Robin McGrew-Zoubi

The purpose of this study was to evaluate the potential of World Wide Web Home Page construction as a way for teachers to demonstrate their professional development as they construct new professional knowledge and networks. The focus of this pilot study was to begin looking at the connections to learning that a Home Page can demonstrate without having to train the teacher as a computer programmer. The teacher subjects (n=7) participated in a constructivist based summer institute to promote excellence in science teaching. The use of and publishing on the Internet were stressed as essential skills of the 20th century science teacher with teacher participants contributing to a collaborative home page. Teachers with no Internet experience prior to the institute were able to begin contributing to the collaborative Home Page with less than four hours of Internet "surfing" and thirty minutes of HTML code (the code of the Web) programming instruction.

Smith, Coralee S. **Strand G** **Monday, April 1, 1996**
10:30 am — 12:00 pm
Frisco

Questions Asked by Elementary Science Teachers Using Moving and Still Frames of Videodisc Instruction

Lloyd H. Barrow

The purpose of this study was to examine the categories of teacher-asked questions while using moving and still frames of science videodisc instruction. Videotapes were made of 12 volunteer, Midwestern, urban, elementary teachers using videodisc instruction. Coding of the teacher-asked questioning categories was determined using an adaptation of The Question Category System for Science (QCSS) by Blosser (1973). Frequencies and percentages of question categories during moving and still frames of videodisc instruction were computed. Statistical analysis showed there were no significant differences in the questioning categories asked by teachers during the moving or still frames of videodisc instruction.

Smith, Michael J. **Strand H** **Monday, April 1, 1996**
8:30 am — 10:00 am
New York Central

Dilemmas Created by Infusing the Nature of Science into Earth Science Curricula

The purpose of this case study was to characterize the challenges encountered by a middle school science teacher as she implemented a curriculum that infused the nature of science into instructional tasks and classroom discourse. The month-long unit required her sixth grade students to interpret geological data, consider their interpretations in the context of plate tectonic theory, and construct arguments about the likelihood of a volcano affecting their community. Results indicated that the complexity of working with geological data led to a wide range of interpretations and subsequent conclusions. This diversity created a number of dilemmas for the teacher, who sought not only to foster an understanding of how to evaluate the quality and validity of investigative results, but also to have students reason about how results contribute to their scientific explanations. The findings lead to an argument for reformatting content guides accompanying curriculum so as to (1) engage teachers in thinking about the nature of geology and geological knowledge prior to implementation; and (2) provide explicit frameworks to help teachers understand how evaluative criteria can serve their instructional goals related to the nature of science.

Songer, Nancy B

Strand G **Monday, April 1, 1996**
1:00 pm — 2:30 pm
Frisco

Teachers, Science Education Reform, and Innovative Technology: Case Stories From the Kids as Global Scientists Project

Telecommunications technologies are bringing dramatically new and interactive real-time events into K-12 classrooms. However, despite the tremendous wealth of interesting information available, few classrooms are poised to take advantage of these resources for many reasons, including a lack of appropriate curricular structures, and a dearth of understanding of the educational potential and limitations of these materials. In this presentation, we will discuss the successes and continued challenges experienced over three years of curriculum development and refinement with the Kids as Global Scientists research project. We will provide examples of how integrating the best features of one new technology, the Internet and its resources, into middle school science can encourage dramatic and interesting educational changes to occur which are distinct from those which might occur from implementing reform ideas alone. Changes observed include: dramatic new challenges for learning and teaching by teachers, the development of more personalized understandings in science, and an increased motivation to learn by some special population students and others who might not normally view themselves as enthusiastic contributors and learners.

Speering, Wendy

Strand B **Monday, April 1, 1996**
4:00 pm — 5:30 pm
Grand E

Changing Schools, Changing Science: A Student's Point of View

Léonie Rennie

The purpose of the study was to investigate the effect of changing from primary to secondary school on students' attitudes toward science. A longitudinal research design was used, and both quantitative and qualitative data were collected from a cohort of students, first at the primary school level, and subsequently at the high school level. A subsample of ten students was selected for a series of interviews over the period of the study. This paper explores the students' view of the transition from primary to secondary school through the eyes of one student whose experiences specifically illustrate some of the more general findings. The results of the study indicate that the changes in teacher-student interaction associated with changes in methods of instruction have a significant effect on students' attitudes to, and perceptions of, science. Girls were particularly affected by the changes, and this may have long term implications for subject and career choices.

Steuck, Kurt

Strand G **Monday, April 1, 1996**
8:30 am — 10:00 am
Frisco

Instruction in Scientific Inquiry Skills

The goal of the Fundamental Skills Training (FST) project is to develop, evaluate, and transfer three intelligent tutoring systems (ITSs) to public schools and, where appropriate, to industry, under federal technology transfer guidelines. Embedded in this statement are three requirements that have an impact on the project. They are: 1) to support public education, 2) to conduct research on automated training systems, and 3) to transfer technology from the laboratory to the public sector for use within public education and commercial training settings. Currently in the middle of the pilot evaluation, we are collecting data on student use of the system ISIS, Instruction on Scientific Inquiry Skills , which teaches scientific inquiry skills in the context of introductory biology. We are reviewing and revising instructional materials, such as the skill instructional modules based on student and teacher input. Posttests were given to students in the treatment and non-treatment groups at the end of the academic year. Finally, we will implement the second year evaluation in 15 junior and high schools in six states across the nation.

Stobler, Milton

Strand E **Monday, April 1, 1996**
10:30 am — 12:00 pm
Regency B

Does Science Olympiad Make a Difference?

David Butts

The Science Olympiad program is primarily directed toward encouraging students to find science to be a meaningful challenge in an atmosphere that helps them build personal bridges between the excitement of searching for new patterns of knowledge and their continued interest in science related efforts. Thus participation in the program is expected to improve the quality of science education experiences for students, increase their interest in science, provide an academic competition as an alternative to athletic competitions and enhance recognition of outstanding student performance. Of the 75 coaches who participated in the 1994-95 Division B Science Olympiad program in Georgia, 52 were interviewed regarding this experience for both them and their students. Based on teachers descriptions of participation, valued outcomes and future intentions, these conclusions emerged. Teachers saw the enhancement of student interests in science as the most important outcome of the program. They also believed that the organization of the competition is a significant contributor to both student interests and the improving of the science education classroom experiences of students. Accomplishing these goals had a price. It is an intense year long effort which in many cases had minimal support from other teachers and volunteers who already have full time jobs. The intense pressure mounted as time for competition gets close. This pressure causes many coaches to wonder if they have what it takes to continue in the program. However, after a year of exhausting efforts, feeling utterly worn down, there comes the day of the competition. Seeing the excitement and enthusiasm of the team members as they are truly challenged, renews the teacher's commitment, restores their vision and reinvigorates their intention to continue. Students are worth the investment. And then...there is that day and I am ready to go back for a new year!

Stocklmayer, Susan M.

Strand B **Tuesday, April 2, 1996**
10:30 am — 12:00 pm
New York Central

Learning through Different Instructional Styles

Richard Lockwood **Roger Dickinson**

The purpose of this study was to evaluate the effect of providing four different instructional styles for tertiary students in a unit dealing with human motor skills and learning. 120 students were offered a choice between traditional lectures, small group work, multimedia instruction and self-study modes. They were able to choose one or all of these simultaneously. Analysis of this project indicates that many students availed themselves of the opportunity to study by more than one method, and their self-evaluation by pre-and post-test questionnaires indicates enhanced learning and improved attitudes. Their analyses of the strengths and weaknesses of the four modes is described, together with some gender differences in choice and evaluation. This study has implications for improvement of teaching at university level by providing for diverse instructional preferences among tertiary students.

Stofflett, René T.

Strand A **Tuesday, April 2, 1996**
10:30 am — 12:00 pm
Grand C

Facilitating Elementary Teacher Candidates' Understanding of Conceptual Change Theory

This study examined an approach used in a science methods course designed to facilitate elementary teacher candidates' understanding and belief in the Conceptual Change model (CCM), as described by Posner and others (1982). Numerous data sources, including interviews, documents and videotapes of teaching, were used in the analysis. Metalearning strategies appeared to have the greatest impact on the development of understanding of the CCM. Primary areas of difficulty for the candidates were distinguishing intelligibility and plausibility, and understanding that dissatisfaction is with existing conceptions and not with how the content was taught. While over 90% of the candidates understood and believed in the CCM, they evaluated the course very low. This finding demonstrates that, like conceptual change of content knowledge, pedagogical conceptual change can also be a difficult and painful process. Additional research into how to alleviate some of this discomfort, and whether doing so would be beneficial, is recommended.

Stuessy, Carol L.

Strand C

Sunday, March 31, 1996
7:00 pm — 8:30 pm
Illinois Central

Changes in Teacher Cognition with Problem-Solving Instruction: Instructional Planning of Science Activities

Dawn Parker

The purpose of this exploratory study was to describe the changes in middle school teachers' planning of science activities during a teacher enhancement project that involved problem-solving instruction and classroom implementation of a problem-solving curriculum model. The model reflected the cognitive science perspective and integrated these features: students' prior knowledge, declarative knowledge, general strategy and domain-specific strategy knowledge, and instructional strategy. Twenty-eight teachers received instruction in human biology topics in five two-day workshops; in strategic pedagogy and curriculum design in two intensive three-week summer workshops; and in classroom implementation of the curriculum model in five workshops during the subsequent school year. Teachers were interviewed at three points: before and after summer workshops and after classroom implementation. Transcripts were analyzed using pre-decided categories and frequency distributions of categories calculated. Analyses indicated that increased involvement resulted in more complex patterns of planning with more emphasis on salient features of the curriculum model. Most dramatic changes occurred in teachers' attention to students' prior knowledge, which rose during the implementation phase of the project.

Sutman, Frank X.

Strand D

Monday, April 1, 1996
8:30 am — 10:00 am
Grand D

Analyses of Teaching Behaviors During Laboratory Based Instruction (9-14)

Alexandra Hilosky Wang Mei

These two studies determined present practices in teaching the laboratory component of chemistry (science) instruction in two types of beginning college courses and in three types of high school level courses; with the ultimate goal of seeking a more effective means of increasing learning and enhancing intellectual development. The teaching by 26 instructors at 24 institutions of higher education as well as 12 teachers at 12 high schools were studied. 35 institutions, located in the USA and one in Germany, were included. Data related to teaching behaviors practiced by chemistry laboratory instructors was collected through on-site observations using the MR-STBI. This data was supported by information gathered through ethnographic surveys and the Inventory of Piagetian Developmental Tasks, used to assess students' level of cognitive thinking. Two major conclusions from both studies are: (1) present laboratory experiences are simply presented as an add-on to lecture rather than to serve as the driving force for later instruction; ~2) a very high percentage of the instructors' time in laboratory based instruction is spent listening to and responding to procedural questions, with almost no time spent in activities designed to develop or strengthen higher order thinking skills. Recommendations are made for the reorganization of different chemistry courses.

Sweeney, Aldrin E.

Strand F

Monday, April 1, 1996
8:30 am — 10:00 am
Grand A

Language and Culture in the U.S. Public Education System: Emergent Cultural and Political Issues

Alejandro Gallard

Limited English Proficiency (LEP) students and bilingual education cause continuing controversies in our public education system. Language and/or cultural minority students currently continue to be academic underachievers, with a significant percentage not graduating from high school. Regarding mathematics and science achievement, research data present an even more disheartening portrayal. A recent study by the U.S. Department of Education concludes that '...blacks,Hispanics and American Indians are under-represented in science- and math-relatedfields because of the inadequacy of their earlier education. [ ] Compared to white andAsian students, it is found that for minority students: (1) a larger percentage comefrom poor families, (2) a larger percentage attend disadvantaged schools, (3) a largerpercentage are perceived by teachers as being inattentive and disruptive, and (4) alarger percentage were in low track achievement groups and non-college preparatoryprograms' (NSTA, 1995). Although written with specific concern regarding themathematics and science achievements of minority students, this paper supersedesthis exclusivity. We suggest that the sociopolitical theory of 'Cultural capital' is usefulin trying to understand language and cultural minority students' tendency tounderachieve academically, and in proposing how an educational system may berestructured to address this problem.

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Tal, Revital T.

Strand E **Monday, April 1, 1996**
4:00 pm — 5:30 pm
Regency B

A Case Study as a Tool for Evaluating an Industry-Environment Project

Yehudit J. Dori **Reuven Lazarowitz**

Environmental Education (EE) advocates system approach and interdisciplinarity. Theoretical and practical projects constitute an important teaching/learning tool in EE. The majority of curricular projects within science education and STES deal with natural environment and help students getting acquainted with nature and appreciating it. However, education related to industrial environment - an integral part of contemporary human environment, is less developed. The goal of the Nature-Industry-Community curriculum is to endow students with knowledge and understanding of concepts in these STES-related areas. They should realize the complexity of the interdependencies among the various aspects involved and develop system approach. The curriculum has been developed for the elementary school of Kfar-Vradim, a community village at Tefen region at the northern part of Israel. The case studies within the curriculum are based on real events taken from actual environmental conflicts around Tefen region. A case study concerned planning and constructing a controversial road linking the region of Tefen to the nearby southern city, was given as a post course questionnaire and students' responses were categorized and analyzed. Overall, the approach of integrating projects and case studies into the curriculum has proven to be effective as well as attractive to students, teachers and parents and should be implemented in additional community schools.

Talsma, Valerie L.

Strand D **Tuesday, April 2, 1996**
4:00 pm — 5:00 pm
Grand C

Science Autobiographies: What Do They Tell Us About Preservice Elementary Teachers' Attitudes Towards Science and Science Teaching?

This study examined the effects of formative experiences on the attitudes of preservice elementary teachers (PETs) towards science and science teaching. Students in a science course in a elementary teacher preparation program wrote autobiographical essays about their experiences in science. These essays (n=56) were analyzed for patterns relating to experiences in the elementary, middle school and high school years as well as non-formal and collegiate experiences. The influence of other people and PETs representations of scientists were also examined. The analysis shows the importance of hands-on experiences at the elementary and middle school levels and the importance of teacher's attitudes towards science across all grade levels in influencing a positive attitude towards science. The findings also indicate that negative attitudes can be improved by providing relevant hands-on experiences in science in a teacher preparation program.

Taylor, Beatrice L.

Strand B **Monday, April 1, 1996**
1:00 pm — 2:30 pm
Wabash Cannonball

Perspectives on Collaboration in the Classroom: Students, Scientist, Classroom Teacher, and Researcher

John Kowalski **Mara Sabre**

The purpose of this study was to examine the procedures used by high school biology students as they investigated a Science-Technology-Society (STS) project as it related to the principles of constructivism, collaborative learning, and problem solving. The study spanned five months. One of the findings included the perceptions of the classroom teacher, scientist, and researcher as they collaborated in the construction of this project. An ethnography was written using data from journals, questionnaires, interviews, audio and video tapes. Analysis was performed by (1) becoming familiar with the data through transcription, (2) systematic searching and arranging materials to increase understanding, (3) doing "member checking" with those studied for validation of the information, and (4) constructing themes and making connections to the research questions. Analysis of the data showed that students and facilitators progressed through the same steps and arrived at similar conclusions regarding their participation in this study. It was the consensus of students and facilitators that (1) learning was enhanced in a collaborative environment, (2) mistakes were accepted as a part of the learning process, (3) self-esteem was intensified, and (4) participation in another collaborative S-T-S study was desired.

Taylor, Peter

Strand H **Tuesday, April 2, 1996**
2:30 pm — 3:30 pm
Missouri Pacific

School Science: A Fertile Culture for the Evolution of Myths

Catherine Milne

From a critical constructivist perspective, we are interested in exploring the nature of the constitutive discursive practices of the culture of school science. We are concerned that teachers are largely unaware of the mythical status of many of these practices and the subsequently impoverished and disempowering image of the nature of science and scientific knowledge that they construct with their students. We describe myths as narrative accounts of collective experience that serve to legitimate certain ways of knowing, valuing, feeling and acting that regulate and order social reality. From our examination of the history of science and teacher practice we have identified 10 myths that relate to the practice of science in the classroom. We argue that an awareness of the historical development of ideas about the nature of scientific activity and legitimation of scientific knowledge is necessary if we want to develop amongst students a critical appreciation of current myths of school science.

Templin, Mark

Strand A **Wednesday, April 3, 1996**
10:30 am — 12:00 pm
Jeffersonian

Dialogic Assessment Products: A View of Student Scientific Literacy in Action

This study investigates the assessment products of eight students to uncover scientific literacy-related themes in their work and changes in these themes over time. These students were engaged in a classroom assessment environment which promoted student work, reflective thinking, and shared-authority over assessment standards. The author analyzed the assessment products using a scientific literacy framework which draws on a sociocultural perspective. Preliminary results indicate that these assessments give a view of student thinking in action, presenting the teacher with opportunities to enter into conversation with students about their thinking over time. The utility of this form of classroom-level assessment for teachers is discussed.

Thomas, Jeff A.

Strand E **Sunday, March 31, 1996**
8:30 pm — 10:00 pm
Regency A, B, C

The Development of a Wetland Attitude Defensibility Inventory

Rosalina Hairston

The purpose of this study was to develop an instrument that measures attitudes of high school students about wetlands and to analyze their attitudes based on knowledge. The instrument consists of four scenarios depicting dilemmas with contrasting action plans that would preserve or destroy wetlands in a hypothetical community. The dilemmas presented by the scenarios are followed by questions related to comprehension of the dilemmas, the proposed action plans, a choice on the proposed action plans, and a task to rank the importance of concepts and ideas used in making their decision. These concept statements were collated and ranked by frequency and the five statements with highest frequencies were included in the final instrument. The first draft of the inventory was field tested to 170 high school students. The investigators found that students respond without problems to the format. The final version of the inventory will be field tested using high school students to determine internal consistency, construct and face validity. A panel of high school biology teachers will establish the content validity of the instrument.

Tims, Joanne

Strand C **Tuesday, April 2, 1996**
4:00 pm — 5:00 pm
Wabash Cannonball

Teacher Change in a Mandatory District-Wide Professional Development Course

Mark H. Brooks Hedstrom

The purpose of this study was to document teacher change in a mandatory district-wide professional development course. It was found that despite opposition from many participants stemming from the mandatory nature of the course, positive change was realized for a majority of the participants, including teachers who would not have attended the course were it not mandatory. The course met for two hours every other week through most of the academic year and focused on reformed and research informed teaching practices. Changes in the attitudes and teaching practices of participants were appraised through interviews, classroom observations, reviews of their course journals, two surveys, and interviews with the instructors. The significant discontent present at the beginning was more pronounced because the district failed to inform the teachers about the course until two days before the beginning of the school year. Yet change was observed on several fronts. Most teachers, although not all, changed their view of what constitutes good teaching, adopting a view that more closely matches what is supported by educational research. To a more limited extent change in classroom behavior was observed among the participants, and continued growth on this front can be reasonably expected.

Tobin, Kenneth

Strand B **Wednesday, April 3, 1996**
10:30 am — 12:00 pm
Regency C

Constraining the Learning of Science: Profiles of Power, Social Forces, and Discursive Capital.

The paper examines the teaching and learning of chemistry in a grade 10 class comprising students with diverse ethnic, cultural and social backgrounds. An interpretive research methodology was employed in the investigation which employed a theoretical frame that examined teaching and learning from the viewpoint of the teacher and students belonging to different communities of discourse. The results highlight the manner in which social forces from within and outside of the class shape the enacted curriculum, that power is constituted within the discourse of the communities that interact to mold the curriculum, and that the discursive capital of students is of little value in learning canonical science, which is perceived by students as having little relevance to their lives out of school. The paper examines the struggles of the teacher as she endeavors to increase the relevance of the curriculum in a context in which traditional criteria are used by others to judge her effectiveness.

Treagust, David F.

Strand A **Monday, April 1, 1996**
4:00 pm — 5:00 pm
Grand F

Improving Teaching and Learning in Science Education

Reinders Duit **Hans Niedderer** **James J. Gallagher** **Vincent N. Lunetta**

This international symposium brings together informed research on the contribution of constructivist ideas for investigating students' conceptions, improving teaching and curricula, and enhancing teacher education. The presenters subscribe to many shared principles of constructivism but these are interpreted in independent ways. The overall intention of the symposium is to examine and critique some of the strengths of constructivism, the variety of ways in which it can be interpreted, and how it has informed practice.

Treagust, David F.

Strand A **Sunday, March 31, 1996**
7:00 pm — 8:30 pm
Jeffersonian

The Relationship between Teachers' Preferred Explanations and the Nature of the Science Content

Louise Tyson **Grady Venville** **Allan Harrison** **Carol Boulter**
John Gilbert

The objective of this symposium is to investigate the relationship between teachers' preferred explanations and the nature of the science content. Specifically, we are interested in examining the teaching and learning procedures that teachers see as being most effective for addressing different kinds of content. The content is selected from the domains of physics, biology and chemistry taught at the secondary high school level. The papers presented in this symposium will illustrate how properties of the science content, such as openness to common experience, abstraction, complexity, or presence of alternative models with explanatory power, both limit and influence the types of explanations used by teachers.

Trowbridge, John E.

Strand C **Tuesday, April 2, 1996**
8:30 am — 10:00 am
Wabash Cannonball

The Road to Scientific Literacy Can Be Lost at Critical Junctures

James H. Wandersee

A well-established trend in science education reform is the move towards the goal of scientific literacy. A marine science-based model called Gulf literacy was developed as a microscale working model of scientific literacy. The following questions guided this study: 1. Can a meaningful model of Gulf literacy be developed? A. How can a content analysis of coastal zone newspapers inform this model? B. How can expert knowledge inform this model building? 2. Are there critical junctures in the attainment of Gulf literacy? A model of Gulf literacy was developed through content analysis of coastal newspapers and expert interviews. A curriculum guide (booklet) emphasizing graphics was developed for a two-week unit on the Gulf of Mexico. Students' development of Gulf literacy was assessed by interviews, concept mapping, and questionnaire. Students' conceptual understanding of the Gulf of Mexico was well founded for human impacts related to Gulf. Physical/chemical processes were poorly understood (possibly due to teacher selection of activities and the existence of critical junctures such as the one at the concept of dead zones). The use of microscale models of scientific literacy such as this Gulf literacy model may help inform the larger scientific literacy reform efforts.

Tuan, Hsiao-Lin

Strand C **Monday, April 1, 1996**
1:00 pm — 2:30 pm
Missouri Pacific

A Year Long Study of a Beginning Taiwanese Science Teacher's Pedagogical Content Knowledge and Its Development

Rong-Cheng Kao

The purpose of this study was to investigate a female beginning Taiwanese physical science teacher's pedagogical content knowledge and how the knowledge changed during her first year of teaching. Data collection included twice classroom observations per week for tone year, interviews of Shu-May before and after her classroom teaching, and written document collections including Shu-May's lesson plan, notes and students' tests, etc. Findings revealed that Shu-May's pedagogical content knowledge representation in the class was composed of the following components: introducing terminology, using natural phenomena to motivate students' learning, explaining the definition of concepts or principles, providing examples to re-emphasize concepts, using concepts applied in calculation situation, evaluating students' understanding, etc. Her knowledge of students became richer and richer, however, her knowledge of pedagogy and content became more and more simplify. Shu-May's knowledge of beliefs and her pedagogical knowledge influenced her pedagogical content knowledge change. Suggestions and discussion would be presented in the paper.

Tyson, Louise

Strand A **Sunday, March 31, 1996**
8:30 pm — 10:00 pm
Regency A, B, C

Development of a Two Tier Test to Examine Students' Understanding of Chemical Equilibrium

David Treagust **R. Bucat**

The objective of this research was to construct a two tier test designed to explore the explanatory frameworks used by students' when they solve problems in chemical equilibrium. Alternative conceptions relating to chemical equilibrium were identified through examination of related literature and by conducting two pilot studies using a questionnaire in multiple choice format with free response in the second tier. Data from the pilot studies indicated that there was more than one correct reason available for the second tier of each question and it was decided that the test would be designed to examine the types of reasoning implemented by students when solving problems in chemical equilibrium. Ten items were developed that tested propositional knowledge related to making predictions about changes made to reactions at equilibrium. The second tier of these items included three approaches that can be used to solve these problems, Le Chatelier's Principle, the equilibrium law and collision theory, as well as alternative conceptions identified in earlier stages of the test development. The results indicate that students used more than one explanatory framework when solving problems in chemical equilibrium and their preference is dependent on the context of the problem.

Underwood, Scott A

Strand B **Sunday, March 31, 1996**
7:00 pm — 8:30 pm
Grand B

Leaving Elementary School with a Sense of Order in Nature

Adrienne T. Gibson **William W. Cobern**

Ninth graders in Arizona high schools have just left their elementary, general science education and are at the start of more specialized secondary science education. They are beginning a course of study that will form the foundation for tertiary education and employment after high school graduation. The research asked, "Who are these students entering high school science courses?" The researchers noted that one of the key objectives of elementary education was to foster in children the concept that nature is inherently orderly and thus amenable to scientific investigation. Since the concepts of order and disorder are fundamental in one's perception of reality, the researchers reasoned that qualitative worldview interviews on nature would be revealing of these concepts. The research led to this assertion: After 9 years of schooling, the level of science integration within everyday thinking remains low among ninth graders. Their discussions of nature involve little use of school science knowledge. Students often name-drop school science topics such as the ozone layer, rain forests, or the Big Bang theory. In other words, they mention such topics without elaboration even when asked. In spite of elementary science education experiences, many students did not see much order in nature.

van Zee, Emily H.

Strand B **Sunday, March 31, 1996**
7:00 pm — 8:30 pm
Grand D

The Nature of Collaborative Conversations About Science and Education in School Settings and at Professional Meetings

Marletta Iwasyk **Akiko Kurose** **Dorothy Simpson**

We begin with a short poster session in which we present data from case studies of conversations about science and mathematics and from a study of collaborative groups. Then we will meet in small groups in which participants formulate claims about the nature of collaborative conversations. Participants can use data from our studies as evidence to back claims; they also can draw upon their own experiences in participating in collaborative conversations in schools and at professional meetings. Issues that might be discussed include why we engage students and colleagues in collaborative conversations, what kinds of conversations we conduct in what contexts, how we help individuals feel safe enough to participate, how we encourage non-speakers to attend to speakers, how we maximize the number of individuals who contribute and minimize disruptions, how and when we bring an idea or issue to closure, and what similarities and differences we find across grade levels, disciplines, and professional settings. We plan to close the session with a large group discussion in which we construct recommendations for fostering collaborative conversations at NARST and other professional meetings.

Varanka-Martin, MaryAnn

Strand F

Monday, April 1, 1996
4:00 pm — 5:30 pm
Grand A

Inside a Gender-Sensitive Environment: An All Girls Physics Class

An all girls' section of a required, tenth grade physics class in a traditional, public, rural high school was developed and studied by the teacher-researcher to determine what characteristics of the classroom environment, instructional practices, and curricular materials supported girls' science learning. Case study methodology analyzed students' and teacher's reflections, multiple types of student work and audio- and videotaped classroom interactions. A conscious and deliberate teacher role established and sustained parameters critical to girls' enhanced success and self-concept. Critical classroom environmental factors included celebration of girls' strong identity and respect of girls as central players in science. Successful instructional practices incorporated development and/or enrichment of supporting skills, improvement of participation strategies, reflective analysis, and self-empowering strategies. Gender sensitive and/or personalization of curricular materials, examples and problems change student understanding and learning. Modifying a physics class through the practice of gender sensitivity created a change in girls' feelings, interests and attitudes about physics and themselves as science students.

Varelas, Maria

Strand B

Tuesday, April 2, 1996
2:30 pm — 3:30 pm
Wabash Cannonball

Focus on Theory-Data Dialectic: Teachers' and Students' Constructions

Joe Becker

This paper is part of a larger project combining research and service in science education, particularly in urban, inner-city schools. The project includes extensive collaboration between elementary school teachers from Chicago Public Schools and university faculty. Teachers work closely with their colleagues and university faculty to develop science units that engage students in the interplay between theory and data (theory-data dialectic)--developing theories, collecting data, and coordinating these two levels, and implement these units in their classes. This gives us an opportunity to explore teachers' developing constructions of the theory-data dialectic as well as their students', the interaction between them, and to study research questions partly identified through our previous work. How do teachers and students develop the theory-data dialectic in the context of specific phenomena and physical systems? What successes and difficulties do they experience as they try to develop a coherent scientific story / model / theory that gives meaning to the phenomenon? How do they use their model to generate questions that they could study empirically? How are teachers' conceptions of the theory-data dialectic played out in their teaching and how does this help students construct their understandings of scientific activity?

Varrella, Gary

Strand C

Sunday, March 31, 1996
7:00 pm — 8:30 pm
Missouri Pacific

Expertise in Inservice Science Education: Relationship between Science Teachers' Beliefs and Practice

This paper looks at the consistency between how teachers actually teach and what those teachers think about the learning environment. The central role that epistemology plays in teachers' personal beliefs about teaching and corresponding day-to-day practice serves as the basis for this work. This study subscribes to the perspective that teachers build conceptual structures which influence their daily teaching. For the more expert teacher a corresponding richness of personal beliefs is reflected and demonstrated through the complexity and effectiveness of their constructivist teaching habits. A newly developed evaluative rubric used to measure teacher's individual perceptions of the relationship between the students and the instructor in the learning environment was used to quantify the teachers' perceptions.

Vazques-Abad, Jesus

Strand D **Tuesday, April 2, 1996**
4:00 pm — 5:00 pm
Frisco

Fostering The Use of Microcomputer Based Laboratories in Secondary Science in Quebec

Laura Winer **Jonathan Toker**

This presentation reports on the experience of university researchers working in collaboration with teachers and pedagogical advisors to encourage the use of a Microcomputer Based Laboratory (MBL) in science teaching. Three courses were identified as being amenable to the use of MBLs (chemistry, physics and physical science) and four protocols were developed (reaction rates, colour and concentration, simple motion and the conservation of momentum). The protocols were tried by teachers and revised before being used by students. General strategies for encouraging successful protocol development will be elaborated and obstacles to the integration of MBLs will be discussed.

Vazquez-Abad, Jesus

Strand B **Monday, April 1, 1996**
4:00 pm — 5:30 pm
Grand E

Perceptions about Persistence in Undergraduate Physics

Laura R. Winer **Jean-Robert Derome**

This presentation reports on a study of factors influencing student persistence in undergraduate physics programs at Université de Montréal carried out by researchers in the Faculty of Education in collaboration with the Department of Physics. Roughly 35% of entering students graduate with a degree in physics, a fact which though not unusual, was cause for concern by department administrators. In-depth interviews were conducted with eight students, four of whom who had abandoned their studies in physics and four of whom who had continued. Results indicated problems of students' feelings of inadequacy as well as problems with the curriculum and quality of teaching. Subsequent interviews were conducted with six professors and two administrators which confirmed some findings and shed new light on other issues. A Likert-scale questionnaire was developed, piloted and administered to all students enrolled in the different physics programs. Results of the data analysis and conclusions will be presented. Recommendations made for departmental action will also be discussed.

Veal, William R.

Strand G **Monday, April 1, 1996**
2:45 pm — 3:45 pm
Jeffersonian

A Mennonite Community: A Supplemental Definition of Technology

Denise Crockett

The purpose of this study was to investigate how a Mennonite community constructs understandings of technology in the church, school, and businesses. Our research centered on three questions that explored how one community of Mennonites view technology: 1) What purpose does technology serve in the schools, businesses, and the homes? 2) Is our supplemental definition of technology embraced by this community? 3) Why is technology used sparingly in this community? Critical theory was used as an ideology from which the researchers evaluated and guided their research questions and analysis. Findings support a critical influence of technology in the community, and indicate that the community views and uses technology in a non-Western manner. The supplemental definition of technology is found within certain aspects of the community, but not in others. The findings have educational ramifications for inservice and preservice teachers.

Volkmann, Mark

Strand D **Monday, April 1, 1996**
4:00 pm — 5:30 pm
Jeffersonian

Inventing a Professional Practice of Teaching

Maria Anderson

This collaborative study focuses on the teaching experiences of the second author, as described in her personal journal, kept during her first year as a high school chemistry teacher at an urban parochial high school. A hermeneutic phenomenological theoretical perspective (Van Manen, 1991) focused our efforts on understanding the underlying thematic structure of these experiences. Our analysis and interpretation examine the conflict between the obligation to be a teacher/adult and the desire to be a student/adolescent. We pay particular attention to how these conflicts influenced Maria's interactions with students, teachers, and administrators in situations calling for fairness, friendliness, and authority. This analysis explicates the issues and concerns Maria faced as she struggled to do the right thing as a science teacher. This research has implications for the preparation of secondary science teachers and the reform of science teacher education programs.

Vopava, Judy

Strand C **Sunday, March 31, 1996**
7:00 pm — 8:30 pm
Missouri Pacific

Expertise in Preservice Science Teaching Across 10 National Sites: The Salish Project Year II

The Salish Consortium is the first an only project sponsored by the Council of Scientific Society Presidents (CSSP). It was developed to evaluate 10 national science and mathematics preservice programs. The Salish Consortium is researching, evaluating and using its new knowledge to develop improved teacher preparation. Salish is assessing key variables in preserve education programs, then measuring the recent graduates, and following their progress during the first three years of the new teaching careers. The project is linking the teaching variables to their teacher preservice program variables. The data are to be publicly debated and integrated into a redesign of mathematics and science preservice education across the ten institutions. The results of the first year data analysis at the program and teacher levels will address commonalities and unique characteristics of the 10 sites.

Waldrip, Bruce G.

Strand B **Monday, April 1, 1996**
10:30 am — 12:00 pm
Regency A

Multicultural Learning Environments: Influence of Culture on Science Learning

Geoff J. Giddings

This study utilised cultural factors that are common to different ethnic groups. These factors may be held to a different extent by different groups. The purpose of this study was to develop and validate an instrument to assess these cultural factors and to examine associations between these cultural factors and students' perceptions of their preferred learning environment. An instrument, namely the Students' Learning and Cultural Environment (SLACE) was developed and was based on Hofstede's four dimensions of culture. The reliability and discriminant validity for each of the eight scales was obtained. The SLACE and the Classroom Environment Scale (CES) were administered to 500 secondary science students in Australian, Melanesian and Polynesian classrooms. This study did not attempt to distinguish between different ethnic groupings, but rather examined the relationships (if any) between groups having similar cultural values and their preferred learning environment. The preliminary results indicated that students with different cultural expectations had different preferences for classroom learning environment. For example, students who revealed that they were not particularly threatened by classroom competition tended to react positively to closer ties with fellow students, viewed teacher support as being positive and non-threatening, and were much more likely to become involved in various forms of classroom interaction. As in past learning environment research, male students consistently perceived their learning environment more favourably than did their female counterparts.

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Wallace, Josephine D.

Strand C **Monday, April 1, 1996**
8:30 am — 10:00 am
Jeffersonian

The Description of Leadership Models for Professional Development in Science and Mathematics

Catherine R. Nesbit **Anne Courtney Miller**

The purpose of this study is to describe the seven leadership models which emerged at eight university sites during 15 two-year lead teacher professional development programs. There were 360 teachers from 180 elementary schools who participated in the programs to become lead science and/or mathematics teachers. The leadership models evolved and were identified from data collected through interviews, observations, and program documents. The leadership models varied in the amount of proactivity that was expected of the lead teachers. The sphere of influence, where the change was implemented, also differed across models. An in-depth description of two of the fifteen leadership models is presented.

Wang, Su-Shiang

Strand B **Monday, April 1, 1996**
8:30 am — 10:00 pm
Grand E

Factors Involved in Science Classroom Climate: A Case Study of an Elementary School Science Teacher

Ching-Yang Chou **Chao-Ti Hsiung**

The purposes of this study were to understand the characteristics of the classroom climate, to explore the interactions among the whole class and to inquire into the factors affecting the classroom climate which a Taiwan exemplary elementary science teacher created. Interpretative research methodology was applied in this study. The data were collected by means of classroom observations, interviews, field notes, documents collection, questionnaire survey and so on. The classroom was observed for twenty-seven periods of class. The teacher was interviewed for about eight hundred and fifty minutes. Results revealed that the harmonious relationships between teacher and her students, with frequent peers interactions created a positive, active, cheerful, democratic, warm, self-confident and disciplinary atmosphere in her class. Meanwhile, results also indicated ten factors which the case teacher mainly affected her classroom climate. Those are: (1) reflective thinking, (2) personal and others perceptions of teacher (Hsya) image, (3) professional growth, (4) teaching beliefs, (5) philosophy of science, (6) personality, (7) styles of leadership, (8) classroom management, (9) teacher's expectation and (10) metaphors for teaching. Based on the findings, the study's educational implications and suggestions for further research were provided.

Warden, Melissa A.

Strand H **Tuesday, April 2, 1996**
2:30 pm — 3:30 pm
Regency C

Biology Workshop '95: Exploring the Nature of Science

Juli K. Eflin

Biology Workshop '95 describes a one week professional development opportunity which was offered to university faculty responsible for teaching the core courses to departmental majors. The purpose of the workshop was to assist biology faculty in making innovative pedagogic changes to their courses that would clearly illustrate the nature of science. In so doing, it was hoped that students in these courses would move from the status quo of memorizing "facts" to the realization that such facts belong to larger scientific patterns which, in turn, fit into broad intellectual frameworks that help define what science is. Participants were administered a pre and post self-evaluation instrument which rated not only their personal understanding of seven basic themes (the nature of science, the philosophy of science, scientific reasoning, critical thinking, logic, and inductive and deductive reasoning) but also their confidence level related to teaching each of these themes. In addition, participants completed an open-ended questionnaire which elicited their beliefs concerning the advantages and disadvantages, obstacles and incentives associated with including nature of science/logical thinking activities into their existing courses. Results of these surveys as well as student reactions to the participant-created lecture and lab modules will be reported.

Watters, Jim

Strand B **Monday, April 1, 1996**
8:30 am — 10:00 am
Grand E

The Learning Environment in a Physics Classroom

Keith B. Lucas

Increasingly, there are calls for reform of science classrooms towards learning environments more conducive to the development of understanding. The purpose of this study was to investigate the learning environment in a grade 12 physics classroom studying rotational motion. Data sources included observation and video recordings of each lesson for four weeks, transcriptions of classroom interactions, a survey of perceptions of the learning environment and interviews with the teacher and students about their views of teaching and learning, understanding and the nature of science. Satisfaction with the learning environment was evident among achieving students and the teacher which resulted in little impetus for change. However, students having difficulty with the physics learning preferred a learning environment more consistent with a sociocultural perspective.

Weller, Herman G.

Strand D **Monday, April 1, 1996**
8:30 am — 10:00 am
Wabash Cannonball

Helping Teachers to Be Novice Scientists: Does It Help Them to Put Their Students in the Same Position?

Mary D. Bird

This is a report on a 3-week summer academy that put 21 elementary teachers in the position of being novice scientists, and an 11-month school-year follow-up during which the teachers developed fully and implemented an inquiry unit at their own schools. We have analyzed the teachers' reflections upon their own-science teaching practice in terms of Smyth's (1989) four forms of action. We also report on their changing conceptions of what doing science is. At least 81% of the teachers apparently did alter their conceptions of teaching (not necessarily their science teaching) in the forms of action described by Smyth to widely varying degrees. Several teachers seemed to have become enthused about adopting various academy teaching methods that were not specific to teaching science (e.g., cooperative, hands-on learning and whole-group generation and analysis of questions), while retaining a fairly linear conception of what doing science is. Nearly all the teachers had to modify their intended inquiry curriculum in some fashion because of school-site constraints.

Westbrook, Susan L.

Strand A **Wednesday, April 3, 1996**
10:30 am — 12:00 pm
Regency C

Nets, Filters, and Glass Ceilings: Discourse and Knowledge Construction in the Science Classroom

The purpose of this inquiry was to examine the relationship between classroom discourse and students' constructions of knowledge in a ninth grade integrated physical science/algebra I class. The researcher observed four students for a three week period during a learning cycle investigation about electric circuits. Data sources included video tapes, audiotapes, field notes, and one-on-one interviews. Analysis of the transcriptions and field notes led to three primary findings. First, there appeared to be a direct relationship between the students' abilities to construct meaning from the laboratory experiments and the science teacher's approach to the whole class discussion. Instead of collecting the diversity of ideas offered by the students, the teacher filtered out information that did not efficiently lead to the desired endpoint. Second, students in the observation group became more reluctant to share ideas and equipment with one another as the investigation progressed. Third, the ideas and questions generated by the students during small group interactions did not make their way into the class discussions and did not become part of the larger class negotiation process.

White, Arthur L.

Strand D

Monday, April 1, 1996
1:00 pm — 2:30 pm
Grand C

Defining a Professional Environment for Teaching

Donna F. Berlin   Michael H. Klapper

The Professional Environment for Teaching Survey (PETS) was designed to develop a profile of teachers' professional environment and support systems. The PETS is a checklist of resources generated from an analyses of written questionnaires and interview data from teachers who had been involved in action research and partnership projects. The PETS consists of 32 items to which a teacher responds with one of three options: GA, generally available and accessible; LA, limited availability; and NA, not available in their situation. The pilot application of PETS surveyed 59 volunteers among teachers who either attended 1993 National Science Teachers Association Area Conventions or participated in the 1988-1993 Action Research Programs. A principle components factor analysis and an orthogonal rotation (Varimax) resulted in the identification of three factors accounting for 41.4% of the variance. The three factors underlying the teachers' responses were identified as: public recognition, appreciation, and support; availability of time and human resources for educational improvement; and communication beyond the school system. In all three categories, teachers perceived that, on average, they had no, or at best limited, access to the items listed in the survey. The results of the pilot application of the PETS suggests that teachers themselves realize their lack of professional standing.

Whitworth, Joan M.

Strand D

Tuesday, April 2, 1996
8:30 am — 10:00 am
Burlington Route

Student Teachers: Outsiders in the Curriculum Reform Process?

This study asked the question: Will placement at an educational reform site transform student teacher beliefs and enhance their knowledge base to match the increased demands of educational reform? In order to find the answer I followed three student teachers during their student teaching experience as they struggled with inconsistencies between their personal view of teaching and the realities of the classroom. Data were collected from a variety of samples of student work, and other documents. The data painted a picture of student teachers engaged in a struggle for survival. A complex set of factors interwoven within each reform site created an unique environment. The implications for this study include: a need for adequate subject matter preparation for aspiring teachers and a realization of problems facing today's teachers; a need for careful selection of schools and support personnel for student teachers who can facilitate the attainment of the university goals for pre-service teachers and include them in the reform process; and the dilemma of the reform setting which may lead to "turning aspiring teachers off to reform."

Wier, Betty A.

Strand B

Monday, April 1, 1996
1:00 pm — 2:30 pm
Wabash Cannonball

Scientist and Elementary Teacher Partnerships: Evolution Through Evaluation

This paper describes the development of a collaborative project which teams scientists and teachers with the goal of combining their expertise to enrich science teaching in elementary classrooms. This partnership project is a major program of the Science Alliance of Delaware and two committees composed of teachers, university faculty, and scientist volunteers have directed the development of the project based on evaluation at each step. The Elementary Committee has developed the partnerships, beginning with a pilot project of 20 teachers and 10 volunteers to the present of nearly 300 teachers and over 100 hundred volunteers. Feedback through observations, surveys, and interviews helped the committee to determine the direction of the project. For example, it determined the most likely places to set up partnerships and that direct assistance to set up and maintain partnerships, including materials and training, is needed. Therefore, funds were secured to establish a resource center to support the partnerships. The Materials and Training Committee also developed workshops to provide teachers and volunteers with support in establishing partnerships, using materials effectively, and addressing the new state science standards. Evaluations of workshops and materials provided continuing feedback to improve the center and training and establish new types of partnerships.

Wieseman, Katherine

Strand E **Monday, April 1, 1996**
8:30 am — 10:00 am
Regency B

Surfing Science Curriculum Reform: On the Crest of a Wave or Caught in the Wave Break?

Deborah J. Tippins Michael J. Padilla JoEllen Roseman Sharon Nichols
Susan Loucks-Horsley

The purpose of this symposium is to create a context for discussing science curriculum reform from the perspectives of stakeholders at various levels of curriculum change (e.g., national, state, district, school, subject, and teacher/class). The session is intended to provide a forum for discussing linkages and "gaps" that occur and issues that emerge when curriculum is translated at and between different levels. The session will include an 1) overview of the national standards movement and the vision of AAAS for implementation of Benchmarks at state and local levels; 2) a discussion of the evolution of a state science framework designed to help schools create their own curriculum; 3) a discussion of research findings that have emerged from an intensive case study of one of the first school districts in Georgia to use the new state learning framework for mathematics and science as a basis for curriculum renewal; 4) a synthesis of issues which focuses on the pitfalls, strengths and aspirations of the standards-based reform movement; and, 5) an interactive component in which all participants, in small groups, will consider criteria that are necessary for reform to take place.

Wiggins, John R.

Strand D **Monday, April 1, 1996**
4:00 pm — 5:30 pm
Jeffersonian

Components of a Science and Mathematics Teacher Induction Model

Kim Nichols

The purpose of this study was to examine participants' perceptions of an induction program designed to assist beginning science and mathematics teachers. Eight beginning teachers participated in the program. Each novice was assigned a teacher from within the same school to serve as an internal mentor and was also assigned a mentor external to the school setting. The internal and external mentors were experienced teachers who were matched with novices based on subject area. Monthly beginning teacher seminars, which were recorded and transcribed, were also included in the program. All participants completed open-ended questionnaires and participated in individual and group interviews. Findings revealed that participants believed the internal mentors to be the primary source of support and that subject matter matching enhanced the process. The external mentors provided disparate amounts of support, but the beginning teachers believed this to be a potentially valuable component. The mentors varied, however, in their assessments of the usefulness of the external mentor in the induction process. Lastly, some beginning teachers found the monthly seminars to be extremely valuable, while one felt them to be formal "gripe sessions" and suggested that greater attention be given to problem resolution during the seminars.

Williamson, Vickie M.

Strand A **Monday, April 1, 1996**
2:45 pm — 3:45 pm
Grand D

Computer Animation, Mental Modeling, and Algorithmic-Conceptual Equilibrium Problem Solving of College Chemistry Students

Mark S. Cracolice

Differences in algorithmic and conceptual problem solving have been documented at various levels of college chemistry. In a previous study (Williamson & Abraham, 1995), conceptual understanding for general chemistry students was increased with the use of computer animation at the particulate level during lecture. This study explored how the benefit of short-term animations varied for students in introductory and general chemistry. Student understanding of equilibrium at both the conceptual (figurative) and algorithmic (mathematical) levels were investigated after treatment with animations depicting the particulate nature of matter during chemical equilibrium. The role of reasoning ability as measured by the Test of Logical Thinking was also investigated. No differences were found between classes with the algorithmic problems. The differences found between classes with the conceptual problems were explained by the differences in reasoning ability. It seems that higher reasoning ability leads to quicker understanding of conceptual material presented in the animations. Well-developed logical reasoning ability may be crucial for the conceptual understanding and development of adequate mental models of chemical processes. We believe that a greater emphasis on teaching process skills prior to these courses is implied. This provides implications for precollege chemistry classes.

Wilson, Julie L. **Strand D** **Tuesday, April 2, 1996**
4:00 pm — 5:00 pm
Grand B

Implementation of Problem Solving Among Teachers Involved in a Problem Solving Demonstration Classroom Inservice

The purpose of this study was to assess the implementation of problem solving among teachers involved in an alternative inservice format. Thirteen teachers participated in a year long inservice which included: a workshop, follow-up meetings, classroom visits, and observations of a teacher using problem solving in the class. Teachers were observed using a scale that was developed qualitatively and collaboratively. Participating teachers were observed each time they completed a problem solving lesson in their classroom. Dependent t-tests were used to analyze the eight observed categories. Results indicate that involvement in this inservice format significantly improved having students work cooperatively, students actively participating in science, the role of the teacher, and students generating their own problems and plans. Students communicating and students managing materials did not significantly change.

Workman, Margaret A. **Strand B** **Monday, April 1, 1996**
10:30 am — 12:00 pm
Grand B

A Qualitative Analysis of the Chemistry Graduate Student Experience

George M. Bodner

The goal of this study is empowerment - to provide the information that would allow graduate students in chemistry to make informed decisions and to provide the information that could guide Departments when making changes in their graduate programs. The guiding research question for this study was: "What is the essence of the experience of being a graduate student in a Chemistry Department?" Within this broad context, particular attention was paid to the experiences that made some students decide to leave the Ph.D. program with an M. S. degree, whereas others choose to stay in the program and earn their Ph.D. A funnel-design methodology, which consisted of three phases, was used to probe graduate students' experiences. The first phase involved a broad survey of the graduate students in a Chemistry Department. Phase II consisted of two focus groups (one male, one female) of three people each. In Phase III, two students (one male, one female) who had decided to leave the Ph.D. program with an M.S. degree were interviewed in depth.

Wright, Emmett L. **Strand D** **Tuesday, April 2, 1996**
4:00 pm — 5:00 pm
Grand B

The Effect of Intensive Instruction on the Problem Solving Skills of Pre-Service Teachers in Both Clinical and Classroom Settings

This study assessed the effect of intensive instruction in cue attendance on preservice teachers abilities to identify and analyze the components of scientific problems and to hypothesize and test solutions for the problems. Dependent variables measured included (l) the quantity and types of cues identified, (2) the quantity and quality of hypotheses generated, (3) the quantity and diversity of information search questions asked, and (4) the quantity and quality of tests of the proposed hypotheses. Results indicated that subjects intensively instructed in cue attendance performed significantly better on all dependent variables when compared to the control group except for the quantity of hypotheses and the quantity of tests of hypotheses, in both clinical and classroom settings. These findings are interpreted to mean that the intensively instructed group was significantly better at identifying relevant details in a scientific problem, asked a more diverse set of questions about the problem, and generated a higher quality of hypotheses and tests of hypotheses. The results provide additional evidence that training pre-service science methods student to become more critical observers of relevant details relates directly to the development of more successful strategies for the solution of science problems.

Yang, Jong-Hsiang

Strand C **Wednesday, April 3, 1996**
10:30 am — 12:00 pm
Regency B

A Beginning Biology Teacher's Knowledge of Students — A Case Study

I-Lin Wu

The purpose of this case study was to describe and demonstrate how does knowledge of students could be the most foundational component of PCK for a beginning biology teacher. Interpretive research method which described by Erickson (1986) was applied in this study. Multiple qualitative data gathering method, including fifty-five periods of classroom observation across the whole academic year, after-class interviews, and triangulation techniques were employed to enhance the validity of the findings. Results indicated that the novice teacher although could create an active classroom environment, but, on the other hand, her poor knowledge of students prevented her from managing more effective communication in the classroom. As the result, the teacher always failed to find appropriate analogies, metaphors, and representations for students' construction of knowledge. For this novice teacher, knowledge of students seems to be the most important foundation for her PCK growth.

Yates, Julie L.

Strand F **Monday, April 1, 1996**
1:00 pm — 2:30 pm
Grand F

Girls and Computing: Gendered Experiences in a Non-Traditional Science Classroom

Elizabeth A. Finkel

This study explored ninth grade girls' interactions with computers in a unique science classroom (Foundations of Science I) where computers and specially designed software were used extensively and the curriculum possessed attributes which should foster girls' interest in and comfort with computing. September and May computer use and attitudes surveys were administered to all ninth grade students. Daily observations of one FOS I classroom were conducted and selected girls were interviewed periodically about their computer experiences. September surveys indicated that boys had greater prior computer experience and confidence levels than girls, but that students' interest in learning about computers was similar. The surveys showed few significant changes in students' computer attitudes after participation in FOS I. Surveys, observations, and interviews revealed gender differences in the types and extent of computer use. While many girls caught up with their male peers in terms of basic computer skills (e.g. word processing), they did not advance toward cutting edge computer use (e.g. Internet) to the same degree as boys. Nor were girls especially comfortable demonstrating their skills or interests in the classroom. Providing easy computer access and a "girl friendly" curriculum was not enough to ensure a truly equitable educational experience.

Yerrick, Randy

Strand G **Sunday, March 31, 1996**
8:30 pm — 10:00 pm
Regency A, B, C

World Wide Web and Traditional Classrooms: An Update of *Tech Tools* and Improving the Use and Access for the Purposes of Improving Science Instruction

Harol Hoffman **Jerry Meisner**

There is an historically unparalleled and discrepant growth between technological advancements and our understanding of implementation of technology into classroom settings. Tech Tools is an NSF funded project (#ESI-9355706) which is designed to provide teachers with current computer and information technologies and provide support for WWW science instruction resource development. These technologies include WWW data gathering and communication, MBL data acquisition, data analysis, presentation software. The Curie system has been developed for organization, collaboration, and dissemination to all users and visitors to the WWW site (http://Curie.uncg.edu). This study is an examination of the implementation of current technologies in workshop and school settings for the purpose of informing other efforts of reform science and technology instruction. Data was gathered through entrance surveys, interviews, and on site visits and observations explicating the 1.) teacher background, 2.) use of computers, 3.) availability, and 4.) support for technology in schools. Preliminary results have been gathered in three areas. These include the 1.) use of equipment, 2.) products of collaboration. and 3.) availability of support and school personnel. Recommendations are given regarding organization and implementation of tested technologies and collaborations.

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Yore, Larry D.

Strand B **Monday, April 1, 1996**
8:30 am — 10:00 am
Grand B

Relationships Among Prior Conceptual Knowledge, Metacognitive Awareness, Metacognitive Self-Management, Cognitive Style, Perception-Judgement Style, Attitude Toward School Science, Self-Regulation and Science Achievement in Gr. 6-7 Students

Trudy Holden

Contemporary interactive-constructive models of science learning emphasize the dynamic relationships among learner, task, context, and cognition. Historically, attribute-treatment-interaction research has not been productive; but interactive-constructive models reinforce the need to explore learner characteristics and their compatibility with various tasks and contexts. This study explored the associations between specific metacognitive, cognitive, and affective attributes and learning biological conceptions in five Grade 6-7 classrooms with five regular teachers using a guided inquiry approach with embedded science reading instruction. The results indicated significant relationships between metacognitive awareness, metacognitive self-management, prior conceptual knowledge, cognitive style, intuiting-thinking style, self-regulation and science achievement. These data support the inference that guided inquiry utilizing concrete experiences, textual materials, and large-group discussion apparently requires learner attributes that are not common in the elementary school population investigated. The dominant characteristics of these Grade 6-7 students were not well matched to the task, treatment, and context. An interesting preliminary result indicates that attitude toward science was significantly associated with metacognition that was significantly associated with science achievement. This may mean that metacognition has an affective component as well as the awareness and executive control components.

Yu, Shu-Mey

Strand D **Monday, April 1, 1996**
8:30 am — 10:00 am
Grand C

Anxiety About Constructivist Science Teaching: A Longitudinal Study

The purpose of this study was to identify whether the strategy of using constructivist practice in an elementary science methods course was effective in reducing preservice elementary teachers' anxiety about constructivist science teaching from learning to teach science till practice teaching. A single group design (O1X1O2X2O3X3O4) was utilized in this study. Anxiety about constructivist science teaching was measured by [State-Trait Anxiety Inventory (STAI) Form Y-1] translated into Chinese by the researcher for use with students in Taiwan. Subjects were 57 preservice elementary teachers enrolled in four sections of a science methods course. They received 6-8 weeks constructivist learning. Then, they designed a science unit by using constructivist approach and taught the unit in their later peer micro teaching. The constructivist science teaching was applied to one year later practice teaching. The instrument was conducted before and after constructivist practice learning, after peer micro teaching, and one year later practice teaching. Analysis of variance (ANOVA) results indicated that constructivist practice was significant ($P<.01$) in reducing preservice elementary teachers' anxiety about constructivist science teaching. Further Tukey's test indicated that the reducing of anxiety about constructivist science teaching was significantly ($P<.05$) last until one year later practice teaching.

Zeilik, Michael

Strand B **Monday, April 1, 1996**
1:00 pm — 2:30 pm
Jeffersonian

Conceptual Astronomy: A Research-Based Paradigm for Teaching Science Classes

Walt Bisard

The overall goal of our project was to improve students' conceptual understanding in large, introductory astronomy courses for non-science majors. To do so, we designed, implemented, and evaluated a new model, based on psychological and educational research, for teaching introductory science classes at the university level -- a model we believe is general. We made structural knowledge explicit by using concept maps and focusing the material around four concept clusters. Cooperative learning in discussion groups was a major strategic innovation. We assessed the impact by traditional and alternative methods, which involved fill-in-the-blank concept maps, a multiple-choice test of difficult concepts, and relatedness ratings (with an expert panel as the referent). We found the increase in student achievement significant and substantial, with a pre/post effect size of 1.86 on the difficult concept questions and one of 0.98 on the concept maps.

Zembal, Carla M.

Strand D **Monday, April 1, 1996**
2:45 pm — 3:45 pm
Grand C

Elementary Student Teacher's Science Content Representations

Joseph S. Krajcik Phyllis C. Blumenfeld

This investigation is based on the case studies of four preservice elementary teachers as they engaged in student teaching. It serves as the final piece in a collection of studies tracing preservice elementary teachers through a two-year teacher preparation program aimed at enhancing the teaching of science at the elementary level. The purpose of this study is to examine (a) where the preservice teachers are with regard to content representation during their student teaching experience, (b) how their content representations during student teaching compare to that of their pre-student teaching, and (c) possible explanations for how the nature of student teaching influences the science content representation of prospective teachers. Findings suggest the student teachers maintained many positive aspects from their pre-student teaching experiences, such as using central ideas to organize representations and planning multiple representations. In addition, they addressed new contextual challenges, such as teaching younger children, with continued sensitivity to content representation. However, the student teachers did not plan science content representations or reflect on their teaching as thoroughly as previously reported. The traditional structure and pressures associated with the context of student teaching are implicated regarding these issues.

Zoller, Uri

Strand E **Tuesday, April 2, 1996**
2:30 pm — 3:30 pm
Regency A

Examination-Type Preferences of Secondary School Students and Their Teachers in the Science Disciplines

David Ben-Chaim

A specially developed questionnaire - Types of Preferred Examinations (TOPE) was used to assess examination-type preferences of secondary school students in the science disciplines - by school type affiliate and gender. Structured interviews were used to assess both students' rationale behind these preferences as well as teacher awareness of these preferences - as contrasted against their actual "examinations practice". Our findings suggest that (a) secondary school students prefer written, unlimited time examinations, which stress, according to their perception, learning' with understanding rather than mechanical rote learning, and in which the use of supporting material ("open book exams") is permitted; and (b) secondary school science teachers are aware of student examination-type preferences; yet they continue to use the traditional written, time-limited - class examination - definitely not preferred (disliked) by their students. In view of the special emphasis in current science education reform, on students' development of higher-order cognitive skills (HOCS) and the need for consonance between the new curriculum goals and examination types used, it is proposed that provisions be made to facilitate teachers' compliance with students' examination-type preferences provided the latter are congruent with learning objectives and our educational aspirations.

PART D

First Authors' Addresses

First Authors' Addresses

Abbas, Abdullah	Florida State University, 209 Carothers Hall, Tallahassee, FL, 32306
Abell, Sandra K.	Purdue U., Department of Curriculum and Instruction, 1442 LAEB, West Lafayette, IN, 47907-1442
Abraham, Michael R.	University of Oklahoma, Department of Chemistry and Biochemistry, Norman, OK, 73019
Adams, Paul E.	Purdue University, 1442 LAEB, West Lafayette, IN, 47907-1442
Agholor, Rose N.	Federal Ministry of Education Lagos, c/o 5th Ave. N. Close, H-5, P. O. Box 3105, FESTAC Town, Lagos, Nigeria
Aikenhead, Glen S.	U. of Saskatchewan, Curriculum Studies, 28 Campus Drive, Saskatoon, Saskatchewan, S7N 0X1
Akatugba, Ayo Harriet	Curtin University of Technology, GPO Box U 1987, Western Australia, 6153
Alexander, Mary M. Cozean	Florida State University - Panama City
Allen, Nancy Jane	University of Texas, Austin, 3568 Ashmere Loop, Round Rock, TX, 78681
Alters, Brian J.	U. of Southern California, WPH 1001A, School of Education, Los Angeles, CA, 90089-0031
Anamuah-Mensah, Jophus	University of Cape Coast, Ag Head, Science Education Dept., Cape Coast, Ghana
Anderson, Maria A.	Purdue University, Department of Curriculum and Instruction, West Lafayette, IN, 47907-1442
Anderson, Ronald D.	University of Colorado, CB 249, Boulder, CO, 80309
Appleton, Ken	Central Queensland U., Faculty of Education, Rockhampton, Queensland, Australia, 4702
Arambula Greenfield, Teresa	U. of Hawaii, Women's Studies Program, 2424 Maile Way - Porteus 722, Honolulu, HI, 96822
Arteaga, Cecilia Ceuvas	Universidad Autonoma Del Estado De Morelos, Calle Tres No. 26, Col. Lomas De Atzingo, Cuernavaca, Morelos, Mexico, 62180
Atwater, Mary M.	University of Georgia, 212 Aderhold Hall, Dept. of Science Education, Athens, GA, 30602-7126
Bailey, Bambi L.	University of Delaware, Department of Chemistry & Biochemistry, Newark, DE, 19716
Barrow, Lloyd H.	U. of Missouri, Southwestern Bell Science Ed. Center, 108 Townsend Hall, Columbia, MO, 65211
Barufaldi, James P.	University of Texas at Austin, Science Education Center SZB 340 D5500, Austin, TX, 78712
Baxter, Louise M.	Central Washington University, Department of Biological Sciences, Ellensburg, WA, 98926
Beeth, Michael	Ohio State Unversity, 253 Arps Hall, 1945 N. High Street, Columbus, OH, 43210
Beilby, Jerry P.	Northwestern College, 3003 Snelling Ave. N., St. Paul, MN, 55113
Bell, Randy	Oregon State U., Science and Mathematics Education, Weniger Hall 237, Corvallis, OR, 97331
Bellamy, Mary Louise	National Association of Biology Teachers, 11250 Roger Bacon Dr., #19, Reston, VA, 22090
Belzer, Sharolyn J.	Idaho State University, Department of Biological Sciences, Box 8007, Pocatello, ID, 83209
Berger, Carl F.	University of Michigan, 1600 SEB, 610 East University, Ann Arbor, MI, 48109-1259
Berlin, Donna F.	Ohio State U., Ctr. for Sci. Teaching and Learning, 1929 Kenny Road, Columbus, OH, 43210-1015
Berrnier, Norma E.	University of Puerto Rico, P.O. Box 19341, San Juan, Puerto Rico, 00910
Bianchini, Julie A.	California State University - Long Beach, 1250 Bellflower Blvd., Long Beach, CA, 90840-4501
Birsner, E. Diane	University of Texas at Austin, 6611 Valleyside Rd., Austin, TX, 78731
Bitner, Betty L.	Southwest Missouri State U., Curriculum and Instruction Dept., U. Park, Springfield, MO, 65804
Black, Kathie M.	University of Victoria, P.O. Box 3010, Victoria, British Columbia, V8W 3N4
Boberg, Wesley S.	Indiana University-Bloomington, 201N. Rose Avenue, Bloomfield, IN, 47405
Bolte, Claus	IPN, University of Kiel, Olshausenstrasse 62, Kiel, Germany, D-24098
Boone, William J.	Indiana University, Science Education, School of Education, Room 3130, Bloomington, IN, 47405
BouJaoude, Saouma	American University of Beirut, Department of Education, 850 Third Ave., New York, NY, 10022
Bourexis, Patricia	The Study Group, Inc
Bowen, Craig W.	U. of Southern Mississippi, Dept. of Chem. and Biochem., Box 5043, Hattiesburg, MS, 39406
Bowen, G. Michael	Simon Fraser University, Faculty of Education, Barnaby, British Columbia, V5A 156
Bowman, Jacqueline K.	Eastern Connecticut State University, Education Dept., 83 Windham St., Willimantic, CT, 06226
Breen, Timothy J.	University of Michigan, 1323 SEB, 610 E. University, Ann Arbor, MI, 48109
Brickhouse, Nancy W.	University of Delaware, 132D Willard Hall, Newark, DE, 19716-2915
Brophy, Sean P.	Vanderbilt University, Learning Technology Center, Nashville, TN, 37203
Brown, Fletcher S.	University of Montana, 121 Liberal Arts Building, Missoula, MT, 59812
Brownstein, Erica M.	Ohio State University, 1255 Neil Avenue, Columbus, OH, 43201
Brunner, D. Allan	Oregon State University, Weniger Hall Room 237, Corvallis, OR, 97331-6508
Bryan, Lynn A.	Purdue University, 1442 Liberal Arts and Education Building, West Lafayette, IN, 47907-1442
Buczynski, Patricia L.	Michigan Department of Education, MEAP Division, P.O. BOX 3008, Lansing, MI, 48909
Burke, Christopher	University of Illinois at Urbana-Champaign, 1310 S. 6th St., Champaign, IL, 61820
Burry-Stock, Judith A.	University of Alabama, P. O. Box 870231, Tuscaloosa, AL, 35487
Caggiano, Mary E.	Boston University, Science Education, 605 Commonwealth Ave., Boston, MA, 02215
Cajas, Fernando	Michigan State University/Universidad de San Carlos de Guatemala, 1641 H. Spartan Village, East Lansing, MI, 48823
Calvert, Renna B.	University of Georgia, 212 Aderhold Hall, Athens, GA, 30602
Carnes, Nathan	Miami University, 420 McGuffey Hall, Oxford, OH, 45056
Carrera, Beatriz	Instituto Pedagogico De Caracas, Av.La Paz El Paraiso, Caracas, Venezuela
Carter, Glenda	North Carolina State University, 900 Westwood Dr., Raleigh, NC, 27607
Caswell, Ruth	Texas Women's University, Box 425859, Chemistry and Physics, Denton, TX, 76204
Cavallo, Ann M.L.	University of Oklahoma, Science Education Center, 820 Van Vleet Oval, Norman, OK, 73019-0260

Change, Wen-Hua	National Changhua U. of Education, Graduate School of Science Education, Taiwan, ROC, 50058
Chiappetta, Eugene L.	University of Houston, 4800 Calhoun, Houston, TX, 77204-5872
Chin, Chi-Chin	National Museum of Natural Science, China, 1, Kuan - Chien Rd., Taichung, Taiwan, ROC, 40419
Chiu, Mei-Hung	National Taiwan Normal University, Graduate Institute of Science Education, 88, Sec. 4, Ting Chou Rd., Tawian, R.O.C., 11718
Chyuan, Jong-pyng	National Taipei Teachers College, 134 Ho-ping E. Road, Sec., 2, Taipei, Taiwan, R.O.C., 10659
Ckhekuri, Nageswar Rao	U. of Cincinnati, OMI College of Applied Science, 220 Victory Parkway, Cincinnati, OH, 45206
Cobern, William W.	Arizona State University West, P. O. Box 37100, Phoenix, AZ, 85069-7100
Collins, Angelo	Vanderbilt University, Peabody College, Mailstop 330, Nashville, TN, 37203
Cooper, C. Kay	KD Enterprises, Inc., 200 South Wind Place, Suite 103, Manhattan, KS, 66503
Cooper, David	Clayton County Schools, P. O. Box 219, Fort Gaines, GA, 31751
Coppola, Brian P.	University of Michigan, 930 N. University Ave., Chemistry Dept., Ann Arbor, MI, 48109-1055
Coulter, Robert	Technical Education Research Center, 2067 Massachusetts Ave., Cambridge, MA, 02140
Craven III, John	University of Iowa, Science Education Center, 458 Van Allen Hall, Iowa City, IA, 52242
Crawford, Barbara A.	Oregon State University, Science and Math Education, Weniger Hall 261, Corvallis, OR, 97331
Crawley, Frank E.	East Carolina U., 357 Flanagan Building, Dept. of Science Education, Greenville, NC, 27858-4353
Crockett, Denise	University of Georgia, 212 Aderhold Hall, Science Education Department, Athens, GA, 30602
Crowther, David T.	University of Nebraska-Lincoln, 211E. Henzlik Hall, P.O. Box 880355, Lincoln, NE, 68501-9988
Cummins, Catherine L.	Louisiana State University, Department of Curriculum and Instruction, Baton Rouge, LA, 70803
Cunningham, Christine M.	Cornell University, 111 Kennedy Hall, Ithaca, NY, 14853
Czerniak, Charlene M.	University of Toledo, 2801 W. Bancroft St., Toledo, OH, 43606
Dagher, Zoubeida	University of Delaware, Educational Development, Newark, DE, 19716
Damnjanovic, Arta	Miami University, 420 McGuffey Hall, Project Discovery, Oxford, OH, 45056
Davis, Kathleeen S.	University of Colorado - Boulder, 4949 Eisenhower Dr., #D, Boulder, CO, 80303
Davis, Nancy T.	Florida State University, 209 MCH, Tallahassee, FL, 32306-3032
Dawson, George O.	Florida State University, Science Education, Tallahassee, FL, 32306-3032
Demastes, Sherry S.	U. of Utah, Department of Educational Studies, 307 Milton Bennion Hall, Salt Lake City, UT, 84112
Deng, Zongyi	Michigan State University, 116 Erickson Hall, East Lansing, MI, 48824
Deru, David B.	University of Georgia, Department of Science Education, 212 Aderhold Hall, Athens, GA, 30602
Deshon, Fred	Education Department of Western Australia, 151 Royal Street, East Perth, Western Australia, 6004
Desouza, Shireen J.M.	Georgia Southwestern University, 800 Wheatley Street, Americus, GA, 31709
Devi, Bharati S. K.	University of Georgia, Science Education Department, 212 Aderhold Hall, Athens, GA, 30602-7126
Dickinson, Valerie L.	Oregon State U., Department of Science and Math Ed., Weniger Hall 237, Corvallis, OR, 97331-6508
Dickman, Carolyn	Radford University, PO Box 6959, Radford, VA, 24142
Doherty, Cindy L.	Florida State University, 1304 Mt. Batten Rd., Tallahassee, FL, 32301
Dori, Yehudit J.	Technion - Israel Institute of Technology, Department of Education in Technology and Science, Technion, Haifa, Israel, 32000
Dorough, Donna K.	Pennsylvania State University, 163 Chambers Building, University Park, PA, 16802
Doster, Elizabeth C.	University of Georgia, 212 Aderhold Hall, Athens, GA, 30602
Doubler, Susan J.	TERC, 2067 Massachusetts Ave., Cambridge, MA, 02140
Dryden, Michael	Dallas Independent School District, 3700 Ross Avenue, Dallas, TX, 75204
Duffy, Maryellen	University of Massachusetts, Lowell, Beacon Street, Amesbury, MA, 01913
Duit, Reinders	IPN, University of Kiel, Olshausenstrasse 62, Kiel, Germany, D-24098
Dundle, Rebecca A.	Florida State University & DeLand Middle School, Science Education, Tallahassee, FL, 32306-3032
Eichinger, David C.	Purdue University, WTHR 221 B, West Lafayette, IN, 47907
Elliott, Thomas	University of Georgia, Science Education Department, 212 Aderhold Hall, Athens, GA, 30602
Enochs, Larry	University of Wisconsin - Milwaukee, P.O. Box 413, 269 Enderis Hall, Milwaukee, WI, 53201
Escalada, Lawrence T.	Kansas State University, Department of Physics, Manhattan, KS, 66506-2601
Estep, Michele R.	East Carolina University, Science Education Dept., 357 Flannagan, Greenville, NC, 27858-4353
Falk, Joni	TERC, 2067 Massachusetts Avenue, Cambridge, MA, 02140
Farr, Pamela L.	North Thurston School District, 305 College St. N.E., Lacey, WA, 98516
Ferguson, Peter D.	U. of Tasmania, Faculty of Education, P.O. Box 1214, Launceston 7250, Tasmania, Australia, 7250
Ferguson-Hessler, Monica	Eindhoven University of Technology, Department of Applied Physics, P.O. Box 1513, NL - 5600 MB EINDHOVEN, Netherlands
Fetters, Marcia K.	U. of North Carolina-Charlotte, Dept. of Curriculum and Inst., College of Ed., Charlotte, NC, 28223
Fife, Barbara	Northville Public Schools, 19338 Old Bridge Court, Northville, MI, 48167
Fischler, Helmut	Free University, ZI Fachdidaktien, Habelschwerdter Allee 45, Berlin, Germany, 14195
Fisher, Robert L.	Illinois State University, 5960 - Illinois State University, Normal, IL, 61790-5960
Flage, Lynda R.	University of Georgia, 1280 Twin Lakes Rd., Athens, GA, 30606
Flick, Lawrence B.	Oregon State University, 263 Weniger Hall, Corvallis, OR, 97331
Foley, Kathy	Northern Valley Regional High School, Central Avenue, Old Tappan, NJ, 07675
Foulks, Barbara	Radford University, P.O. Box 6959, Radford, VA, 24142
Fraser, Barry J.	Curtin University of Technology, GPO Box U1987, Perth, Australia, 6001
Fraser-Abder, Pamela	New York University, 43 Westview Rd., New Hempstead, NY, 10097
Frederick, Ronald C.	Columbia Public Schools, Rock Bridge Sr. H. S., 4303 South Providence Rd., Columbia, MO, 65203

Freedman, Robin Lee Harris	University of Iowa, 470 Van Allen Hall, Science Education Center, Iowa City, IA, 52242-1478
French, M. Jenice	Kansas State University, 249 Bluemont Hall, 1100 Mid Campus Dr., Manhattan, KS, 66506-5328
Gabel, Dorothy L.	Indiana University, School of Education, 201 N. Rose, Bloomington, IN, 47405
Gallagher, James J.	Michigan State University, 327 Erickson Hall, East Lansing, MI, 48824-1034
Gallard, Alejandro Jose	Florida State University, 203 MCH-3032, Tallahassee, FL, 32306-3032
Gattis, Kenneth W.	North Carolina State University, Box 7105, Raleigh, NC, 27695
Gee, Carrie J.	Indiana University-Bloomington, Education 3130, 201N Rose Ave., Bloomington, IN, 47405-1006
Geiser, Helmut	IPN, University of Kiel, Olshausenstrasse 62, Kiel, Germany, D-24098
Germann, Paul J.	U. of Missouri, Southwestern Bell Science Ed. Center, 108 Townsend Hall, Columbia, MO, 65211
Gess-Newsome, Julie	U. of Utah, Department of Educational Studies, 307 Milton Bennion Hall, Salt Lake City, UT, 84112
Gibson, Adrienne T.	Cactus Shadows High School
Gilmer, Penny J.	Florida State University, Department of Chemistry, Tallahassee, FL, 32306-3006
Ginns, Ian	Queensland University of Technology, Centre for Mathematics and Science Education, Locked Bag No. 2, Red Hill Qld., Australia, 4059
Glass, Merton L.	Cumberland College, Dept. of Ed., 7792 College Station Drive, Williamsburg, KY, 40769-1388
Glasson, George E.	Virginia Institute of Technology, Dept. of Teaching and Learning, Blacksburg, VA, 24061-0313
Golley, Priscilla	Georgia State University, College of Education, MSIT, 6th Floor, Atlanta, GA, 30303
Gough, Annette G	Deakin University
Gough, Noel	Deakin University
Graeber, Wolfgang K.	IPN, University of Kiel, Olshausenstrasse 62, Kiel, Germany, D-24098
Greenfield, Teresa Arambula	University of Hawaii, 2424 Maile Way - Porteus 722, Honolulu, HI, 96822
Griffiths, Noelle	Florida State U., Department of Curriculum and Instruction, 209 MCH, Tallahassee, FL, 32306-3032
GropengieBer, Harald	University of Oldenburg, Germany
Groves, Fred	Northeast Louisiana University, Department of Curriculum and Instruction, Monroe, LA, 71209
Gunstone, Richard	Monash University, Faculty of Education, Clayton 3168, Victoria, Australia, 3168
Guo, Chorng-Jee	National Changhua U. of Education, Graduate Institute of Science Ed., Changhua, Taiwan, ROC, 500
Guy, Mark D.	U. of North Dakota, P.O. Box 7189, Center for Teaching and Learning, Grand Forks, ND, 58202-7189
Gwimbi, E. M.	U. of Zimbabwe, Dept. of Science and Mathematics Ed., Box MP 167, Mt Pleasant, Harare, Zimbabwe
Hairston, Rosalina	University of Southern Mississippi, Hattiesburg, MS, 39406
Haley-Opiphant, Ann	Miami University, 467 McGuffey Hll, Oxford, OH, 45056
Halloun, Ibrahim	Arizona State University, Dept. of Physics and Astronomy, Box 871504, Tempe, AZ, 85287-1504
Hamilton, Beatrice	Australian Catholic University, P.O. Box 650, Ballarat, Victoria, Australia, 3353
Hammrich, Penny L.	Temple University, 337 Ritter Hall (003-00), Philadelphia, PA, 19122
Haney, Jodi J.	Bowling Green State University, 123 Life Science Bldg., Bowling Green, OH, 43403
Harrison, Allan G.	Curtin University of Technology, SMEC, GPO Box U1987, Perth, Western Australia
Harrison, Christine	King's College, London, Cornwall House, Waterloo Rd., London SEI 8WA, England
Hayes, Michael T.	University of Utah, 304 MBH, Salt Lake City, UT, 84112
Helly, Maggie	Mosley High School, Florida
Helms, Jennifer V.	Stanford University, 129 Churchill Ave., Palo Alto, CA, 94301
Hennessey, M. Gertrude	St. Ann's School, Science Department, 342 N. Harrison Street, Stoughton, WI, 53589
Henriques, Laura	University of Iowa, 450 VAN - Science Education Center, Iowa City, IA, 52242
Hicks, Bruno G.	University of Maine, 372 River Rd., Dover-Foxcroft, Maine, 04426
Hildebrand, Gaell	U. of Melbourne, LASE Dept., Alice Hoy Building Education Faculty, Parkville, Victoria, Australia, 3052
Holliday, William G.	University of Maryland, Department of Curriculum and Instruction, College Park, MD, 20742
Hsiung, Chao-Ti	National Taipei Teachers College, 134, Sec.2 Ho-Ping E. Rd., Taipei, Taiwan, R.O.C.
Huang, Hsiang-Wu	National Taiwan Normal University, 88 Sec.4 Ting-Chou Rd., Taipei 117, Taiwan, ROC, 117
Huang, Hui-Ju	University of Illinois, Department of Curriculum and Instruction, 310 S. Sixth St., Urbana, IL, 61801
Huang, Iris T.	National Kaohsiung Normal U., Graduate Institute of Science Ed., Kaohsiung, Taiwan, R.O.C., 800
Hudson, Sharon P.	Morehead State University, 504 Ginger Hall, Morehead, KY, 40351
Hug, J. William	Pennsylvania State University, P. O. Box 33, Pine Grove Mills, PA, 16868
Hurst, Roy W.	U. of Texas - Permian Basin, School of Education, 4901 E. University Blvd., Odessa, TX, 79762
Jackson, David F.	University of Georgia, 212 Aderhold Hall, Athens, GA, 30602
James, Robert K.	Texas A & M University, EDCI, College Station, TX, 77843-4232
Jarrell, Ranald	Arizona State U. West, College of Education-3151, P.O. Box 37100, Phoenix, AZ, 85069-7100
Jarvis, Tina	Leicester University, School of Education, 21 University Road, Leicester, United Kingdom, LE1 7RF
Jbeily, Kamil A.	Texas Education Agency, 1410 West 29th, Austin, TX, 78703
Jeffrey, Kodi R.	Louisiana State University, Museum of Natural Science, 119 Foster Hall, Baton Rouge, LA, 70803
Jegede, Olugbemiro	University of Southern Queensland, Distance Education Centre, TIIWIINBA, Australia, QKD 4350
Jensen, Murray	General College, U. of Minnesota, 220 Appleby Hall, 128 Pleasant St. SE, Mpls., MN, 55455
Johnson, Judith	U. of Central Florida, Lockheed Martin/UCF Academy, College of Ed., Rm. 146, Orlando, FL, 32816
Johnson, Sally	King's College, London, Cornwall House, Waterloo Rd., London SE1 8WA, England
Johnson, Valora M.	Georgia Institute of Technology, CEISMC, 500 Tech Parkway, Atlanta, GA, 30332-0282

Jones, Gail	University of North Carolina at Chapel Hill, CB# 3500, Chapel Hill, NC, 27599-3500
Jones, Leslie S.	Ohio State University, 129 E. Beaumont, Columbus, OH, 43214
Kahle, Jane Butler	Miami University, 420 McGuffey Hall, Oxford, OH, 45056
Kamen, Michael	Auburn University, 5040 Haley Center, Auburn, Alabama, 36840
Kattmann, Ulrich	University of Oldenburg, Germany
Katz, Phyllis	University of Maryland, 841 Bromley Street, Silver Springs, MD, 20902
Kelly, Christine	University of Maryland, College Park, P.O. Box 129, Prarie Lea, TX, 78661-0129
Kerner, Nancy	University of Michigan, 3541 Dow Chemistry, Ann Arbor, MI, 48109
Kesidou, Sofia	Am. Assoc. for the Advancement of Sci., 1333 H. St., NW, Project 2061, Washington, D.C., 20005
Keys, Carolyn W.	Georgia State University, MSIT Department, University Plaza, Atlanta, GA, 30303-3083
Khourey-Bowers, Claudia	Canton City Schools, 617 McKinley Ave. S.W., Canton, OH, 44707
Kirk, Maria K.	College of Notre Dame of Maryland, Chemistry Dept., 4701 N. Charles St., Baltimore, MD, 21210
Klapper, Michael H.	Ohio State University, NCSTL, 1929 Kenny Rd., Columbus, OH, 43210
Koba, Susan	Omaha Public Schools & University of Nebraska at Lincoln, 4410 N. 36th St., Omaha, NE, 68111
Koballa, Jr., Thomas R.	University of Georgia, 212 Aderhold Hall, Athens, GA, 30602-7126
Komorek, Michael	IPN, University of Kiel, Olshausenstrasse 62, Kiel, Germany, D-24098
Kurth, Lori A.	Michigan State University, Dept. of Teacher Education, 301 Erickson Hall, East Lansing, MI, 48824
Labudde, Peter	University of Bern / AHL, Muesmattstr. 27a, Bern, Switzerland, CH - 3012
Landis, Carol	Onio State U., Ed. Studies, Science Ed. 249 Arps Hall, 1945 N. High St., Columbus, OH, 43210
Lang, Manfred	IPN, University of Kiel, Olshausenstrasse 62, Kiel, Germany, D-24098
Larson, Jane O.	University of Colorado-Boulder, PSC 78 Box 4321, APO AP96326-4321
LaRussa, Annette	U. of Georgia, Performance Assessment Laboratory, 115 Sycamore Drive, Athens, GA, 30602-9101
Latz, Mark S.	Oregon State U., Dept. of Science and Mathematics Ed., Weniger Hall 237, Corvallis, OR, 97331
Lavoie, Derrick R.	University of Northern Iowa, Department of Biology, Cedar Falls, IA, 506214-0421
Lee, Okhee	University of Miami, School of Education, P.O. Box 248065, Coral Gables, FL, 33124
Lennon, Patrick Alan	Southeastern Oklahoma State University, Biology, Durant, OK, 74701
Leonard, Mary Alice	North Carolina State University, Box, 7801 NCSU, Raleigh, NC, 27695-7801
Lewis, Scott P.	Altamonte Springs, Florida, 1000 Douglas Avenue #39, Altamonte Springs, FL, 32714
Liang, Ling L.	Indiana U., Bloomington, Dept. of Curriculum and Inst., School of Ed., Bloomington, IN, 47405
Lin, Shu Hua	National Chang-hua University of Education, Department of Biology, Taiwan, ROC
Lin, Weir-Sen	Taiwan, 2F, No. 6, Alley 15, Lane 266, Sec. 4, Jen-Ai Rd., Taipei, Taiwan, ROC
Lindauer, Ivo	University of Northern Colorado, Department of Biology, Greeley, CO, 80639
Liu, Chin-Tang	University of Iowa, 761 Van Allen Hall, Science Education Center, Iowa City, IA, 52242-1478
Lohrke, Charles T.	Western Michigan University, Center for Science Education, Moore Hall, Kalamazoo, MI, 49008
Lord, Thomas R.	Indiana University of Pennsylvania, Weyandt Hall, Indiana, PA, 15705
Loving, Cathleen C.	Texas A&M University, Department of EDCI, College Station, TX, 77843
Lucas, Keith B.	Queensland University of Technology, Locked Bag 2, Red Hill, Queensland, Australia, 4059
Lumpe, Andrew T.	University of Toledo, College of Education, Toledo, OH, 48144
Lynch, Sharon	George Washington University, 2134 G. Street, NW #402, Washington, DC, 20052
Marlow, Michael	U. of Colorado at Denver, School of Ed., Campus Box 173364, P.O. Box 106, Denver, CO, 80217
Martinello, Marian L.	University of Texas at San Antonio, Division of Education, San Antonio, TX, 78249-0654
Mason, Diana	U. of Texas at Austin, Wel 3.140 A5300, Dept. of Chemistry and Biochem., Austin, TX, 78712-1167
Matkins, Juanita Jo	U. of Virginia, Curry School of Education, 214 Ruffner Hall, Charlottesville, VA, 22903-2495
Matthews, Michael R.	University of New South Wales, School of Education Studies, Sydney, Australia, 2052
Mattson, Sue	Harvard-Smithsonian Center for Astrophysics, 60 Garden Street, Cambridge, MA, 02138
McClurg, Patricia A.	University of Wyoming, P.O. Box 3992, Laramie, WY, 82071
McConney, Amanda Woods	Western Michigan University, 241 Moore Hall, Dept. of Science Studies, Kalamazoo, MI, 49008
McCormack, Alan J.	San Diego State U., Center for Research in Mathematics & Science Ed., San Diego, CA, 92182-1862
McDonald, Robert B.	Southwest Texas State U., Dept. of Curr. and Instr., 601 University Drive, San Marcos, TX, 78666
McFadden, Charles	University of New Brunswick, Fredericton, New Brunswick, E3B 6A3
McGinn, Michelle K.	Simon Fraser University, Faculty of Education, Burnaby, British Columbia, VSA 156
McGinnis, J. Randy	U. of Maryland at College Park, Sci. Teaching Ctr., 2226 Benjamin Blvd., College Park, MD, 20742
McGlamery, Sheryl	University of Northern Colorado, 228 Ross Hall, Greeley, CO, 80639
McKenzie, Woodrow L.	Virginia Institute of Technology, Dept. of Teaching and Learning, Blacksburg, VA, 24061-0313
McLoughlin, Andrea	Pennsylvania State University, 157 Chambers Building, University Park, PA, 16802
McMahon, Maureen M.	University of California, Davis, Division of Education, Davis, CA, 95616
McRobbie, Campbell J.	Queensland University of Technology, Centre for Mathematics and Science Education, Locked Bag No. 2., Red Hill, Qld Brisbane, Australia, 4059
Meadows, Lee	U. of Alabama at Birmingham, UAB Station, Room 119 Ed. Bldg., Birmingham, AL, 35294-1250
Meyers, Karen	University of British Columbia, Dept. of Curriculum Studies, 2125 Main Mall, Vancouver, BC, V6T
Milne, Catherine	Curtin University of Technology, GPO Box U1987, Perth, Australia, 6001
Minger, Mark A.	University of Minnesota, 159 Pillsbury Dr. S.E., Minneapolis, MN, 55455-0208
Mintzes, Joel J.	University of North Carolina at Wilmington, 601 S. College Rd., Wilmington, NC, 28403
Misiak, Julia Anne	Centenary College, 400 Jefferson St., Hackettstown, NJ, 07840
Morgan, Wayne R.	Hutchinson Community College, 1300 N. Plum, Hutchinson, KS, 67501

Moscovici, Hedy	Western Washington University, #310 Biology Building, Bellingham, WA, 98225-9160
Muire, Chris	Florida State University, 205 Carothers Hall, Tallahassee, FL, 32306-3032
Murfin, Brian	New York University, 192-50B 71st Crescent, Apt. 1-B, Fresh Meadows, NY, 11365
Naizer, Gilbert L.	Ohio State University at Newark, 1179 University Drive, Newark, OH, 43055
Nakhleh, Mary B.	Purdue University, 1393 Brown Bldg., West Lafayette, IN, 47907-1393
Niaz, Monsoor	Universidad de Oriente, Apartado Postal 90, Cumana, Estado Sucre, Venezuela, 6101A
Nichols, Kim	University of Georgia, 212 Aderhold Hall, Athens, GA, 30602
Nichols, Sharon	University of Texas at Austin, Science Education Center SZB 340 D5500, Austin, TX, 78712
Nickelson, Dennis	Jefferson City High School, 609 Union, Jefferson City, MO, 65101
Nicolaos, Valanides	University of Cyprus, P.O. Box 537, Nicosia, Cyprus
Niedderer, Hans	University of Bremen, FB1-Didaktik Dre Physik, Postfach 330440, D28334, Bremen 33, Germany
Nodurft, Susan J.	University of Southern Mississippi, Center for Science Education, Hattiesburg, MS, 39406
Norman, Katherine I.	University of Texas at Brownsville, 3500 Carmen Ave., Unit 1202, Rancho Viejo, TX, 78520
Norman, Obed	Washington State University, 1812 E. McLoughlin, Vancouver, WA, 98663
Odom, Louis	University of Missouri-Kansas City, 5100 Rockhill Rd. ED 319, Kansas City, MO, 64110
Ogunsola-Bandele, Mercy F.	Ahmadu Bello University, Department of Education, Zaria, Nigeria
Okebukola, Peter A. O.	Lagos State University, Department of Curriculum Studies, PMB 1087, Apapa, Lagos, Nigeria
Oliveira, Mauricia	University of Lisbon, Center for Educational Research, Faculty of Sciences, Campo Grande - C4 1700 Lisboa, Portugal
Oliver, Steve	University of Georgia, 212 Aderhold Hall, Athens, GA, 30602
Olness, Valerie Keeling	Augustana College, Department of Biology, Sioux Falls, SD, 57197
Orion, Nir	Weizmann Institute of Science, Rehovot, Israel, 76110
Padilla, Michael J.	University of Georgia, Science Education Department, 212 Aderhold Hall, Athens, GA, 30602-7126
Palmer, Troy D.	Florida State University, Science Education, Tallahassee, FL, 32306-3032
Palmeri, Amy B.	Vanderbilt University
Parke, Helen M.	East Carolina University, Science Education, 311 Flanagen, Greenville, NC, 27834
Parker, Joyce	Michigan State Universtiy, 323 Erickson Hall, East Lansing, MI, 48824
Parker, Lesley H.	Curtin University of Technology, GPO Box U1987, Perth, Western Australia, Australia, 6001
Parsons, Sharon	San Jose State University, One Washington Square, San Jose, CA, 95192-0074
Patterson, B. Patricia	Wesley College, P. O. Box 83, 120 N. State St., Dover, DE, 19901-3875
Pedersen, Jon E.	East Carolina University, Science Education Department, 351 Flanagan, Greenville, NC, 27858
Peters, Joseph	University of West Florida, 11000 University Parkway, Pensacola, FL, 32514
Peterson, Rita W.	University of California, Irvine, Department of Education, Irvine, CA, 92717
Petrosino, Anthony	Vanderbilt University, Learning Technology Center
Plummer, Donna M.	University of Missouri-Columbia, 5N Tucker Hall, Columbia, MO, 65211
Ponte De Chacin, Carmen	Instituto Pedagogico De Caracas, Av.La Paz El Paraiso, Venezuela
Postlewaite, Elizabeth M.	SeDoMoCha Middle School, Harrison Avenue, Dover-Foxcroft, Maine, 04426
Powell, Kathryn	Texas A&M University, College of Education, EDCI, College Station, TX, 77843-4232
Powell, Richard R.	Texas Tech University, College of Education, Box 41071, Lubbock, TX, 79409-1071
Priestley, Holly	Morrisville High School, NJ
Pyle, Eric J.	West Virginia U., Dept. of Curriculum and Inst., P.O. Box 6122, Morgantown, WV, 26506-6122
Radford, David L.	Louisiana Tech University, P.O. Box 3179 Tech Station, Ruston, LA, 71272
Raghavan, Kalyami	University of Pittsburgh
Raubenheimer, Dianne	Primary Science Programme, P. O. Box 51236, Musgrave, South Africa, 4062
Reinhold, Peter	IPN, University of Kiel, Olshausenstrasse 62, Kiel, Germany, D-24098
Rennie, Léonie J.	Curtin University of Technology, SMEC, GPO Box U1987, Perth, Australia, 6001
Reyes-Herrera, Lilia	Florida State University, 209 Carothers Hall, Tallahassee, FL, 32306
Rice, Diana C.	University of South Carolina - Aiken, 171 University Parkway, Aiken, SC, 29801
Richardson, Lon	New Mexico State University
Riley, Dana	Miami University, 420 McGuffey Hall, Oxford, OH, 45056
Riley, Joseph P.	University of Georgia, 212 Aderhold Hall, Athens, GA, 30602
Rillero, Peter	Arizona State University West, 4701 Thunderbird Rd., Box 37100, Phoenix, AZ, 85069-7100
Rivard, Leonard P.	College universitaire de Saint-Boniface, 200, avenue de la Cathedrale, Winnipeg, Manitoba, R2H 0H7
Robinson, Scott	SUNY College at Brockport, 350 New Campus Drive, Brockport, NY, 14420
Rodriguez, Alberto J.	University of Wisconsin-Madison, 225 N. Mills, Madison, WI, 53706
Roempler, Kimberly S.	Ohio State U., Eisenhower National Clearinghouse, 1929 Kenny Rd., Columbus, OH, 43210
Rogers, Laura N.	University of North Carolina - Wilmington, 2206 Gillettte Dr., Wilmington, NC, 28403
Rogg, Steve	Miami University, 420 McGuffey Hall, Oxford, OH, 45056
Rojas de Astudillo, Luisa	Universidad de Oriente, Av. Rómulo Gallegos, Parque Res. Terrazas Cumanesas Torre 3, Piso 4 Apartamento 4F, Cumaná, Venezuela
Ron, Salit	Technion Institute of Technology, Department of Education in Technology and Science, Technion City, Haifa, Israel, 32000
Ronkin, Jacob	Weizmann Institute of Science, Department of Science Teaching, Rehovot 76100, Israel, 67100
Rop, Charles Jay	Michigan State University, 2970 84th Street, Byron Center, MI, 49315
Roth, Kathleen J.	Michigan State University, 116F Erickson Hall, East Lansing, MI, 48824-1034

Roth, Wolff-Michael	Simon Fraser University, Faculty of Education, Barnaby, British Columbia, V5A 1S6
Rowe, Mary B	Stanford University, School of Education, Ceras - 402 R, Stanford, CA, 94305-3084
Roychoudhury, Anita	Miami University, 420 McGuffey Hall, Oxford, OH, 45056
Rua, Melissa	University of North Carolina at Chapel Hill, CB# 3500, Chapel Hill, NC, 27599-3500
Rye, James A.	West Virginia University, College of HR & E, P.O. Box 6122, Morgantown, WV, 26506-6122
Sanders, Jo	CUNY Graduate Center, 25 West 43 St. #400, New York, NY, 10036
Saturnelli, Annette	Newburgh Enlarged City School District
Scantlebury, Kathryn	University of Delaware, Department of Chemistry & Biochemistry, Newark, DE, 19716
Schaller, John	Florida State University
Scharmann, Lawrence C.	Kansas State University, 364 Bluemont Hall, Manhattan, KS, 66506
Schmidt, Hans-Jürgen	University of Dortmund, Department of Chemistry, Otto-Hahn-Str. 6, 44221 Dortmund, Germany
Schmidt, Julie	University of Deleware, Willard Hall, Newark, DE, 19716
Schmuckler, Joseph S.	Temple University, 456 Ritter Hall, Philadelphia, PA
Schnipper, Linda	Miami University, Project Discovery, 420 McGuffey Hall, Oxford, OH, 45056
Scholer, Anne-Marie	Endicott College, 376 Hale Street, Beverly, MA, 01915
Schoon, Kenneth J.	Indiana University Northwest, 3400 Broadway, Gary, IN, 46408
Schroeder, Patricia	Johnson County Community College, 12345 College Blvd., Overland Park, KS, 66210-1299
Settlage, John	Cleveland State University, 1319 Rhodes Tower, College of Education, Cleveland, OH, 44115
Shaw, Jr., Edward L.	University of South Alabama, 3208 UCOM, Mobile, AL, 36688-0002
She, Hsiao-Ching	National Taiwan Normal University, Science Education Center, 88, Sec. 4, Ting-Chou Rd., Taipei, Taiwan, R.O.C.
Shea, Trudy	Illinois State University, CeMaST #5960, Normal, IL, 61790-5960
Shepardson, Daniel P.	Purdue University, 1442 LAEB, W. Lafayette, IN, 47907-1442
Sherwood, Robert D.	Peabody College of Vanderbilt University, Peabody College MS 330, Nashville, TN, 37203
Shipman, Harry L.	University of Delaware, Physics and Astronomy Dept., Sharp Laboratory, Newark, DE, 19716
Shore, Linda S.	Exploratorium Teacher Institute, 3601 Lyon Street, San Francisco, CA, 94123
Shroyer, Gail	Kansas State University, 229 Bluemont Hall, 100 Mid-Campus Drive, Manhattan, KS, 66505
Shymansky, James A.	University of Iowa, 757 Van Allen Hall, Iowa City, Iowa, 52242
Simmons, Patricia	University of Georgia, 212 Aderhold Hall, Athens, GA, 30602
Simpson, William D.	University of Oklahoma, 820 Van Vleet Oval, Norman, OK, 73019
Sirochman, Rudy F.	Indiana U., W.W. Wright Ed. Building Rm 3130, 201 North Rose Ave., Bloomington, IN, 47405
Slough, Scott	Sam Houston State University, Department of Chemistry, Huntsville, TX, 77341
Smith, Coralee S.	University of Missouri-Columbia, 108 Towensend, Columbia, MO, 65211
Smith, Michael J.	University of Delaware, Educational Development, Newark, DE, 19716
Songer, Nancy B	University of Colorado, School of Education, Campus Box 249, Boulder, CO, 80309-0249
Spector, Barbara	University of South Florida, Dept. of Sec. Ed. 3086, 4202 E. Fowler Ave., Tampa, FL, 33620-5650
Speering, Wendy	Curtin University of Technology, GPO Box U1987, Perth, Western Australia, 6001
Steuck, Kurt	United States Air Force
Stobler, Milton	Georgia Institute of Technology, Atlanta, GA
Stocklmayer, Susan M.	Curtin University of Technology, GPO Box U1987, Perth, Australia, 6001
Stofflett, Rene T.	University of Illinois at Urbana-Champaign, 311 Education, 1310 S. Sixth, Champaign, IL, 61820
Stuessy, Carol L.	Texas A & M University, Educational Curriculum and Instruction, College Station, TX, 77843-4232
Sutman, Frank X.	Temple University, 128 Stratton Ln., Mt. Laurel, NJ, 08054
Sweeney, Aldrin E.	Florida State U., 209 Carothers Hall, Science Education Program, Tallahassee, FL, 32306-3032
Tal, Revital T.	Technion Israel Institute of Technology, Department of Education in Technology and Science, Technion, Haifa, Israel, 32000
Talsma, Valerie L.	U. of Michigan, School of Education, 1323 SEB - 610 E. University, Ann Arbor, MI, 48109-1259
Taylor, Beatrice L.	Fairfax County Public Schools, Fairfax, VA, 22021
Taylor, Peter	Curtin University of Technology, GPO Box U1987, Perth, Australia, 6001
Templin, Mark	University of Michigan, Rm. 4218 SEB, 610 E. University, Ann Arbor, MI, 48109
Thomas, Jeff A.	University of Southern Mississippi, Box 5087, Hattiesburg, MS, 39406
Tims, Joanne	Curtin University of Technology, SMEC, GPO Box U1987, Perth, Western Australia, 6001
Tobin, Kenneth	Florida State University, 209 Carothers Hall, Tallahassee, FL, 32306-3032
Treagust, David F.	Curtin University of Technology, GPO Box U1987, Perth, Western Australia, 6001
Trowbridge, John E.	Southeastern Louisiana University, SLU-749, Hammond, LA, 70402
Tuan, Hsiao-lin	National Changhua U. of Education, Graduate Institute of Science Ed., Changhua, Taiwan, ROC, 50058
Tyson, Louise	Curtin University of Technology, GPO Box U1987, Perth, Australia, 6001
Underwood, Scott A	Cactus Shadows High School, AZ
Van Sickle, Meta	University of Charleston, 3 Sawgrass Blvd., Apt. B1, Charleston, SC, 29412
van Zee, Emily H.	University of Maryland at College Park, Science Teaching Center, College Park, MD, 20742
Varanka-Martin, MaryAnn	Estes Park High School, Estes Park, CO
Varelas, Maria	U. of Illinois at Chicago, College of Ed. M/C 147, 1040 West Harrison Street, Chicago, IL, 60607
Varrella, Gary	University of Iowa, Science Education, Van Allen Hall, Iowa City, IA, 52242
Vazques-Abad, Jesus	U. de Montréal, Dept. de didactique, FSE, C.P. 6128, Succ Centre-ville, Montréal, Quebec, H3C 357
Veal, William R.	University of Georgia, 212 Aderhold Hall, Science Education Department, Athens, GA, 30602-1212

Volkmann, Mark	Purdue University, Dept. of Curriculum and Inst., 1442 LAEB, West Lafayette, IN, 47907-1442
Vopava, Judy	University of Iowa, Science Education, Van Allen Hall, Iowa City, IA, 52242
Waldrip, Bruce G.	Curtin University of Technology, Faculty of Education, GPO Box 1897U, Perth, Australia, 6001
Wallace, Josephine D.	University of North Carolina - Charlotte, 305 Kennedy Building, Charlotte, NC, 28223-0001
Wang, Su-Shiang	National Taipei Teachers College, 134, Sec. 2, Ho-Ping E. Rd., Department of Math and Science Education, Taipei, Taiwan, R.O.C.
Warden, Melissa A.	Ball State University, Department of Biology, CL 121, Muncie, IN, 47306
Watters, Jim	Queensland University of Technology, Centre for Mathematics and Science Education, Locked Bag No. 2, Red Hill, Brisbane, Queensland, Australia, 4059
Weller, Herman G.	University of Maine, College of Education, Orono, ME, 04469
Westbrook, Susan L.	North Carolina State U., Dept. of Mathematics and Science Ed., Box 7801, Raleigh, NC, 27695-1063
White, Arthur L.	Ohio State University, NCSTL, 1929 Kenny Road, Columbus, OH, 43210-1015
Whitworth, Joan M.	Morehead State University, 123 Lappin Hall, Dept. of Physical Sciences, Morehead, KY, 40351
Wier, Betty A.	University of Delaware, College of Eduction, Newark, DE, 19716
Wiesman, Katherine	University of Georgia, 212 Aderhold Hall, Science Education Department, Athens, GA, 30602-7126
Wiggins, John R.	Georgia Institute of Technology, 1011 Osceola Ct., Bogart, GA, 30622
Williamson, Vickie M.	Illinois State University, 5960 - Illinois State University, Normal, IL, 61790-5960
Wilson, Julie L.	University of Arizona, 735 Education, Teaching and Teacher Education, Tucson, AZ, 85721
Workman, Margaret A.	Purdue University, Dept. of Chemistry, 1393 Brown Building, West Lafayette, IN, 47907-1393
Wright, Emmett L.	Kansas State University, 1100 Mid-Campus Drive, 237 Bluemont Hall, Manhatten, KS, 66506
Yang, Jong-Hsiang	National Taiwan Normal U., Dept. of Biology, 88, Ting-Chou Rd., Sec. 4, Taipei, Taiwan, 117
Yates, Julie L.	University of Michigan, 1323 SEB 610 E. University Ave., Ann Arbor, MI, 48103
Yerrick, Randy	East Carolina University, 353 Flanagan, Greenville, NC, 27858-4353
Yore, Larry D.	U. of Victoria, Dept. of Social and Natural Sciences, Box 3010, Victoria, BC, V8V 3G5
Yu, Shu-mey	National Taichung Teachers College, 28, Tai-Yuan S. 2nd St., Taichung, Taiwan, R.O.C., 404
Zeilik, Michael	U. of New Mexico, Dept. of Physics and Astronomy, 800 Yale Blvd. NE, Albuqerque, NM, 87131
Zembal, Carla M.	Louisiana State U., Dept. of Curriculum and Inst., 223 D Peabody Hall, Baton Rouge, LA, 70803
Zoller, Uri	Haifa University-Oranim, Department of Science Education - Chemistry, Kiryat Tivon, Israel, 36006

PART E

Participant Index

(Authors, Symposium Participants, Presiders and Discussants)

Participant Index

Abbas, Abdullah	Mon	4:00 PM	Wabash						
Abegg, Gerald	Tue	10:30 AM	Frisco	Tue	4:00 PM	Frisco			
Abell, Sandra K.	Mon	8:30 AM	NYCentr	Mon	10:30 AM	IllCentrl	Mon	1:00 PM	GrandC
	Wed	10:30 AM	BurlRte						
Abraham, Michael R.	Mon	2:45 PM	GrandD						
Abrams, Eleanor	Tue	8:30 AM	MoPacif						
Adams, Paul E.	Mon	1:00 PM	MoPacif	Tue	4:00 PM	RegncyA			
Adoue, Diane	Tue	2:30 PM	RegncyC						
Agholor, Rose N.	Tue	4:00 PM	RegncyC						
Aikenhead, Glen S.	Mon	8:30 AM	RegncyA	Mon	10:30 AM	BurlRte			
Akatugba, Ayo Harriet	Tue	10:30 AM	Jeffersn						
Al-Momani, Ibrahim	Mon	4:00 PM	GrandC						
Aldahmash, Abdulwali H.	Mon	2:45 PM	GrandD						
Alexander, Mary M. Cozean	Mon	4:00 PM	MoPacif						
Allen, Nancy Jane	Tue	4:00 PM	Wabash						
Allen-Noble, Rosie	Mon	10:30 AM	Wabash						
AlShannag, Qasim	Mon	8:30 AM	RegncyC						
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Anamuah-Mensah, Jophus	Tue	4:00 PM	RegncyC						
Anderson, Maria A.	Mon	10:30 AM	IllCentrl	Mon	4:00 PM	Jeffersn	Tue	8:30 AM	RegncyB
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Arteaga, Cecilia Ceuvas	Tue	8:30 AM	Frisco						
Atwater, Mary M.	Mon	10:30 AM	BurlRte	Mon	1:00 PM	GrandA	Tue	8:30 AM	Jeffersn
	Tue	10:30 AM	GrandC	Tue	4:00 PM	MoPacif			
Audet, Richard	Tue	10:30 AM	Frisco						
Bailey, Bambi L.	Tue	8:30 AM	GrandA	Wed	10:30 AM	GrandA			
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Beeth, Michael	Mon	10:30 AM	Wabash	Mon	1:00 PM	Jeffersn			
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Bell, Randy	Wed	10:30 AM	Wabash						
Bellamy, Mary Louise	Mon	10:30 AM	RegncyB	Mon	1:00 PM	IllCentrl			
Belzer, Sharolyn J.	Mon	10:30 AM	Wabash						
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Berenson, Sarah B.	Tue	8:30 AM	GrandC						
Berlin, Donna F.	Mon	1:00 PM	GrandC	Mon	2:45 PM	MoPacif	Tue	2:30 PM	Jeffersn
Bermier, Norma E.	Tue	4:00 PM	RegncyC						
Bianchini, Julie A.	Tue	8:30 AM	RegncyB						
Bird, Mary D.	Mon	8:30 AM	Wabash						
Birsner, E. Diane	Mon	8:30 AM	Wabash						
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Bitner, Betty L.	Tue	2:30 PM	RegncyC						
Black, Kathie M.	Mon	10:30 AM	GrandE	Tue	10:30 AM	GrandB			

Blackburn, Marcy A.	Mon	8:30 AM	GrandB						
Blanco, Rafael	Wed	10:30 AM	Wabash						
Blumenfeld, Phyllis C.	Mon	2:45 PM	GrandC						
Blunck, Susan	Tue	8:30 AM	RegncyA						
Boberg, Wesley S.	Tue	10:30 AM	MoPacif						
Bodner, George M.	Mon	10:30 AM	GrandB						
Bogan, Margaret	Mon	10:30 AM	Jeffersn						
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Boothby, Linda M.	Tue	2:30 PM	GrandB						
Borchers, Carol	Tue	10:30 AM	GrandB						
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Boutonné, Sylvie	Mon	10:30 AM	GrandD						
Bowen, Craig W.	Mon	10:30 AM	GrandB	Tue	10:30 AM	GrandA	Tue	4:00 PM	GrandC
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Bowman, Jacqueline K.	Tue	4:00 PM	BurlRte						
Breen, Timothy J.	Tue	4:00 PM	RegncyA						
Brickhouse, Nancy W.	Mon	8:30 AM	NYCentr	Mon	4:00 PM	GrandA	Tue	8:30 AM	NYCentr
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Bruce, B. C.	Mon	10:30 AM	GrandA						
Bruckhart, Glen	Tue	8:30 AM	IllCentrl						
Brunner, D. Allan	Mon	4:00 PM	Wabash						
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Bunce, Diane M.	Sun	7:00 PM	Wabash						
Burke, Christopher	Mon	10:30 AM	GrandA						
Burry-Stock, Judith A.	Sun	7:00 PM	MoPacif	Tue	8:30 AM	RegncyA			
Butts, David	Mon	10:30 AM	RegncyB	Tue	10:30 AM	GrandB			
Caggiano, Mary E.	Tue	10:30 AM	Frisco						
Cajas, Fernando	Tue	10:30 AM	Wabash						
Calvert, Renna B.	Mon	1:00 PM	IllCentrl						
Campbell, Lois M.	Mon	8:30 AM	BurlRte						
Carlsen, William S.	Tue	8:30 AM	NYCentr						
Carnes, Nathan	Mon	8:30 AM	MoPacif						
Carrera, Beatriz	Tue	8:30 AM	Frisco						
Carter, Glenda	Mon	1:00 PM	Jeffersn	Tue	8:30 AM	GrandC			
Caswell, Ruth	Mon	2:45 PM	BurlRte						
Cavallo, Ann M.L.	Sun	8:30 PM	RegyABC	Mon	8:30 AM	GrandB			
Cavazos, Lynne	Sun	7:00 PM	GrandA						
Chang, Jing-Yi	Mon	4:00 PM	GrandD						
Change, Wen-Hua	Mon	8:30 AM	GrandC						
Charron, Elisabeth	Tue	8:30 AM	IllCentrl						
Chiang, Chia-Ling	Mon	1:00 PM	GrandB						
Chiappetta, Eugene L.	Tue	8:30 AM	MoPacif						
Chidsey, Jennifer L.	Mon	4:00 PM	GrandC	Tue	2:30 PM	Jeffersn			
Chin, Chi-Chin	Sun	7:00 PM	BurlRte						
Chiu, Mei-Hung	Tue	4:00 PM	BurlRte						
Chiu, Yun-Ju	Mon	4:00 PM	BurlRte						
Chou, Ching-Yang	Mon	8:30 AM	GrandE						
Chubin, Daryl E.	Mon	4:00 PM	Frisco						
Chyuan, Jong-pyng	Mon	4:00 PM	GrandD						

Ckhekuri, Nageswar Rao	Mon 4:00 PM	BurlRte				
Cobern, William W.	Sun 7:00 PM	GrandB	Mon 8:30 AM	GrandC	Mon 10:30 AM	NYCentr
	Tue 10:30 AM	GrandB				
Coble, Charles R.	Mon 8:30 AM	Jeffersn				
Cochran, Kathryn	Tue 8:30 AM	IllCentrl				
Cog. & Tech. Grp., Vanderbilt	Sun 8:30 PM	RegyABC				
Coleman, Pat	Wed 10:30 AM	GrandB				
Collins, Angelo	Sun 7:00 PM	Wabash	Mon 10:30 AM	RegncyC	Tue 4:00 PM	RegncyA
Cooper, C. Kay	Wed 10:30 AM	IllCentrl				
Cooper, David	Mon 10:30 AM	RegncyB				
Coppola, Brian P.	Tue 8:30 AM	Jeffersn	Tue 10:30 AM	GrandA		
Corwin, Rebecca B.	Mon 2:45 PM	Wabash				
Coulter, Robert	Tue 4:00 PM	Frisco				
Cracolice, Mark S.	Mon 2:45 PM	GrandD				
Craven, III, John	Tue 8:30 AM	RegncyB				
Crawford, Barbara A.	Tue 10:30 AM	RegncyB				
Crawley, Frank E.	Mon 8:30 AM	BurlRte	Mon 2:45 PM	MoPacif	Tue 4:00 PM	Wabash
Crockett, Denise	Mon 10:30 AM	BurlRte	Mon 2:45 PM	Jeffersn	Mon 4:00 PM	NYCentr
	Tue 2:30 PM	NYCentr				
Cromwell, Randy	Mon 8:30 AM	BurlRte				
Crowther, David T.	Tue 4:00 PM	GrandC				
Cuddy, Cynthia	Mon 1:00 PM	Jeffersn				
Cummins, Catherine L.	Mon 10:30 AM	NYCentr	Mon 2:45 PM	NYCentr	Tue 8:30 AM	Jeffersn
Cunningham, Christine M.	Tue 8:30 AM	NYCentr	Tue 4:00 PM	MoPacif	Wed 10:30 AM	Wabash
Czerniak, Charlene	Mon 10:30 AM	MoPacif	Tue 8:30 AM	Wabash	Tue 2:30 PM	IllCentrl
	Tue 4:00 PM	GrandC				
Dagher, Zoubeida	Sun 7:00 PM	GrandB	Mon 8:30 AM	NYCentr	Mon 1:00 PM	GrandE
Damnjanovic, Arta	Mon 8:30 AM	MoPacif	Tue 2:30 PM	GrandC		
Dana, Thomas M.	Tue 10:30 AM	GrandC	Tue 2:30 PM	MoPacif	Tue 4:00 PM	RegncyC
	Wed 10:30 AM	GrandB				
Daniel, Patricia	Mon 4:00 PM	Jeffersn				
Daniels, Douglas S.	Tue 8:30 AM	Jeffersn	Tue 10:30 AM	GrandA		
Dargart, Julie A.	Mon 1:00 PM	GrandB				
Daughenbaugh, Richard L.	Mon 10:30 AM	Frisco				
Davis, Kathleeen S.	Mon 4:00 PM	GrandA	Tue 8:30 AM	GrandA		
Davis, Nancy T.	Mon 10:30 AM	GrandE	Mon 4:00 PM	MoPacif	Tue 10:30 AM	RegncyB
	Wed 10:30 AM	GrandB				
Dawson, George O.	Sun 7:00 PM	Frisco	Mon 4:00 PM	RegncyA		
Demastes, Sherry S.	Mon 10:30 AM	NYCentr	Mon 4:00 PM	RegncyC	Tue 8:30 AM	MoPacif
Deng, Zongyi	Tue 10:30 AM	Wabash				
Denning, Rebecca	Mon 8:30 AM	Frisco				
Derome, Jean-Robert	Mon 4:00 PM	GrandE				
Dershimer, Charles	Mon 1:00 PM	Frisco				
Deru, David B.	Mon 1:00 PM	GrandB	Mon 2:45 PM	RegncyB	Wed 10:30 AM	Jeffersn
Deshon, Fred	Tue 8:30 AM	Wabash				
Desouza, Shireen J.M.	Sun 8:30 PM	RegyABC				
Destino, Thomas	Mon 10:30 AM	GrandE				
Devi, Bharati S. K.	Tue 10:30 AM	GrandC				
Dickinson, Roger	Tue 10:30 AM	NYCentr				
Dickinson, Valerie L.	Wed 10:30 AM	IllCentrl				
Dickman, Carolyn B.	Mon 8:30 AM	IllCentrl	Mon 10:30 AM	Jeffersn	Wed 10:30 AM	GrandC
Doan, Robert L.	Mon 10:30 AM	Frisco				
Doherty, Cindy L.	Sun 7:00 PM	Frisco				
Dori, Yehudit J.	Mon 10:30 AM	GrandB	Mon 4:00 PM	RegncyB	Tue 2:30 PM	RegncyC
Dorough, Donna K.	Tue 2:30 PM	MoPacif				
Dossey, John A.	Mon 4:00 PM	RegncyB				
Doster, Elizabeth C.	Mon 1:00 PM	GrandF	Mon 4:00 PM	NYCentr		
Doubler, Susan J.	Mon 2:45 PM	Wabash				
Dryden, Michael	Mon 8:30 AM	GrandE				
Duarte-Noboa, Elsa	Tue 2:30 PM	GrandB				

Duffy, Maryellen	Tue	10:30 AM	NYCentr						
Duggan-Haas, Donald	Mon	8:30 AM	RegncyC	Mon	4:00 PM	Jeffersn			
Duit, Reinders	Mon	1:00 PM	RegncyB	Mon	4:00 PM	GrandF	Tue	8:30 AM	GrandB
Dundle, Rebecca A.	Sun	7:00 PM	Frisco						
Dunkhase, Deborah	Mon	4:00 PM	GrandC						
Dunkhase, John	Mon	4:00 PM	GrandC						
Duschl, Richard A.	Mon	1:00 PM	RegncyB	Tue	8:30 AM	NYCentr	Tue	4:00 PM	NYCentr
	Wed	10:30 AM	RegncyA						
Dutton, Bill	Mon	4:00 PM	GrandC						
Dykstra, Dewey	Tue	8:30 AM	GrandB						
Eflin, Juli K.	Tue	2:30 PM	RegncyC						
Eichinger, David C.	Wed	10:30 AM	Wabash						
Elliott, Thomas	Mon	10:30 AM	RegncyB						
Ellis, James D.	Mon	4:00 PM	Frisco						
Engel, Scott	Mon	1:00 PM	GrandD						
Enger, Sandy	Tue	8:30 AM	RegncyA						
Enochs, Larry G.	Mon	4:00 PM	Frisco	Tue	8:30 AM	RegncyB	Tue	2:30 PM	GrandC
Escalada, Lawrence T.	Mon	1:00 PM	Frisco						
Estabrook, George	Mon	10:30 AM	Wabash						
Estep, Michele R.	Sun	7:00 PM	IllCentrl						
Evans, Robert H.	Mon	8:30 AM	GrandB						
Falk, Joni	Tue	10:30 AM	Frisco						
Farina, Beth	Sun	7:00 PM	GrandC						
Farr, Pamela L.	Mon	10:30 AM	Frisco						
Feldman, Alan	Tue	4:00 PM	Frisco						
Feldman, Arnold	Mon	8:30 AM	Wabash						
Ferguson, Peter D.	Mon	4:00 PM	GrandE						
Ferguson-Hessler, Monica	Mon	10:30 AM	GrandD						
Fetherston, Tony	Tue	8:30 AM	Wabash						
Fetters, Marcia K.	Mon	10:30 AM	GrandA	Wed	10:30 AM	RegncyB			
Fife, Barbara	Mon	2:45 PM	Frisco						
Filkins, Kathleen	Mon	2:45 PM	BurlRte						
Fillman, David A.	Tue	8:30 AM	MoPacif						
Finkel, Elizabeth A.	Mon	1:00 PM	GrandF						
Finley, Fred N.	Mon	1:00 PM	GrandE	Mon	2:45 PM	RegncyA			
Fischler, Helmut	Tue	10:30 AM	Jeffersn						
Fisher, Darrell L.	Mon	10:30 AM	RegncyA						
Fisher, Robert L.	Mon	4:00 PM	RegncyB						
Flage, Lynda R.	Sun	8:30 PM	RegyABC	Mon	10:30 AM	MoPacif	Mon	4:00 PM	RegncyC
Flick, Lawrence B.	Mon	10:30 AM	GrandE	Tue	2:30 PM	GrandC			
Foley, Kathy	Tue	2:30 PM	RegncyC						
Foti, Sebastian	Mon	2:45 PM	Grand E						
Foulks, Barbara	Mon	8:30 AM	IllCentrl						
Fradd, Sandra H.	Mon	8:30 AM	GrandA						
Fraser, Barry J.	Mon	8:30 AM	GrandE	Mon	10:30 AM	RegncyA	Mon	4:00 PM	GrandE
Fraser-Abder, Pamela	Mon	4:00 PM	GrandB						
Frederick, Ronald C.	Tue	10:30 AM	Jeffersn						
Freedman, Robin Lee Harris	Tue	2:30 PM	RegncyB						
Freeman, Robyn	Tue	8:30 AM	RegncyA						
French, M. Jenice	Tue	10:30 AM	GrandB	Wed	10:30 AM	GrandA			
Gabel, Dorothy L.	Sun	7:00 PM	Wabash	Tue	10:30 AM	MoPacif			
Gallagher, James J.	Sun	7:00 PM	IllCentrl	Mon	8:30 AM	RegncyA	Mon	10:30 AM	MoPacif
	Mon	4:00 PM	GrandB						
Gallard, Alejandro Jose	Mon	8:30 AM	GrandA						
Gatewood, Kelly	Mon	1:00 PM	Jeffersn						
Gattis, Kenneth W.	Tue	10:30 AM	NYCentr						
Gee, Carrie J.	Tue	10:30 AM	MoPacif						
Geiser, Helmut	Mon	8:30 AM	GrandB						
Gerber, Charlotte	Wed	10:30 AM	GrandA						
Germann, Paul J.	Tue	2:30 PM	RegncyA						

BEST COPY AVAILABLE

Gess-Newsome, Julie A.	Mon	8:30 AM	RegncyB	Mon	4:00 PM	RegncyC			
Gibson, Adrienne T.	Sun	7:00 PM	GrandB						
Giddings, Geoff J.	Mon	10:30 AM	RegncyA						
Gilbert, John	Sun	7:00 PM	Jeffersn						
Gilmer, Penny J.	Mon	1:00 PM	GrandD						
Ginns, Ian	Tue	10:30 AM	GrandC						
Girault, Emily	Mon	2:45 PM	Grand E						
Glaser, Robert	Mon	8:30 AM	Frisco						
Glass, Merton L.	Mon	8:30 AM	IllCentrl						
Glasson, George E.	Tue	2:30 PM	NYCentr	Tue	4:00 PM	RegncyB			
Goldberg, Fred	Tue	8:30 AM	GrandB						
Golley, Priscilla S.	Mon	10:30 AM	IllCentrl	Mon	4:00 PM	Jeffersn			
Gonzalez-Lantz, Dorcas	Mon	8:30 AM	RegncyA						
Good, Ronald G.	Mon	10:30 AM	RegncyC	Mon	10:30 AM	NYCentr	Tue	4:00 PM	IllCentrl
	Wed	10:30 AM	RegncyA						
Gough, Annette G	Mon	8:30 AM	BurlRte						
Gough, Noel	Mon	8:30 AM	BurlRte						
Graeber, Wolfgang K.	Mon	10:30 AM	GrandB						
Grafton, Trudy	Tue	8:30 AM	Wabash						
Graves, John	Tue	8:30 AM	IllCentrl						
Green, Deborah	Mon	10:30 AM	Frisco						
Greenfield, Teresa Arambula	Mon	8:30 AM	Wabash	Mon	1:00 PM	GrandF			
Griffiths, Noelle	Mon	2:45 PM	Wabash						
Gropengiefler, Harald	Mon	1:00 PM	RegncyB						
Groves, Fred	Mon	4:00 PM	GrandD						
Gunstone, Richard	Tue	8:30 AM	Jeffersn						
Guo, Chorng-Jee	Mon	1:00 PM	GrandB						
Guy, Mark D.	Mon	1:00 PM	Wabash	Wed	10:30 AM	IllCentrl			
Gwimbi, E. M.	Wed	10:30 AM	IllCentrl						
Hagen, Thomas J.	Tue	10:30 AM	Frisco						
Hairston, Rosalina	Sun	7:00 PM	MoPacif	Aun	8:30 PM	RegyABC			
Haley-Opiphant, Ann	Mon	1:00 PM	GrandB	Tue	2:30 PM	RegncyA			
Halloun, Ibrahim	Mon	10:30 AM	RegncyA						
Hamilton, Beatrice	Wed	10:30 AM	RegncyB						
Hamm, Kristin	Mon	8:30 AM	RegncyC						
Hammrich, Penny L.	Mon	10:30 AM	BurlRte						
Haney, Jodi J.	Mon	8:30 AM	GrandC	Mon	10:30 AM	MoPacif			
Harrison, Allan G.	Sun	8:30 PM	RegyABC	Sun	7:00 PM	Jeffersn			
Harrison, C. A.	Mon	8:30 AM	Jeffersn						
Harrison, Christine	Tue	4:00 PM	RegncyA						
Harvey, Stephen	Mon	8:30 AM	Jeffersn						
Harwood, William S.	Sun	8:30 PM	RegyABC	Mon	10:30 AM	GrandB			
Haslam, Filocha	Tue	8:30 AM	Jeffersn						
Hawbee, Ginger	Mon	1:00 PM	Jeffersn						
Hayes, Michael T.	Mon	2:45 PM	RegncyB						
Hazel, Elizabeth	Tue	2:30 PM	GrandA						
Hazelwood, Constanza	Sun	7:00 PM	GrandA						
Heath, Phillip A.	Mon	1:00 PM	GrandC						
Hedstrom, Mark H. Brooks	Tue	4:00 PM	Wabash						
Helgeson, Stanley	Mon	8:30 AM	Frisco						
Helly, Maggie	Mon	4:00 PM	MoPacif						
Helms, Jenifer V.	Mon	2:45 PM	NYCentr	Tue	8:30 AM	NYCentr			
Hemeiri, Maira	Mon	10:30 AM	GrandB						
Hennessey, M. Gertrude	Mon	10:30 AM	Wabash	Mon	1:00 PM	Jeffersn			
Henriques, Laura	Mon	4:00 PM	GrandC	Tue	2:30 PM	Jeffersn			
Hershkowitz, Orit	Tue	2:30 PM	RegncyC						
Herzog, Walter	Wed	10:30 AM	GrandA						
Hestenes, David	Mon	10:30 AM	RegncyA						
Hewson, Peter	Mon	1:00 PM	Jeffersn	Tue	10:30 AM	RegncyA			
Hicks, Bruno G.	Tue	8:30 AM	RegncyB						

Hildebrand, Gaell M.	Mon	1:00 PM	GrandE	Tue	2:30 PM	GrandA			
Hilosky, Alexandra	Mon	8:30 AM	GrandD						
Hoffman, Harol	Sun	8:30 PM	RegyABC						
Hofmeister, Alan	Tue	10:30 AM	RegncyA						
Hofstein, Avi	Sun	8:30 PM	RegyABC						
Holden, Jim	Tue	2:30 PM	RegncyC						
Holden, Trudy	Mon	8:30 AM	GrandB						
Holliday, William G.	Sun	7:00 PM	MidSpec	Mon	1:00 PM	GrandE			
Holthuis, Nicole I.	Tue	8:30 AM	RegncyB						
Howes, Elaine Virginia	Sun	7:00 PM	GrandA						
Hsiung, Chao-Ti	Mon	8:30 AM	GrandE	Mon	4:00 PM	GrandD			
Hsiung, Tung-Hsing	Mon	4:00 PM	GrandD						
Huang, Hsiang-Wu	Mon	4:00 PM	BurlRte						
Huang, Hui-Ju	Mon	10:30 AM	Wabash						
Huang, Hui-lin	Sun	8:30 PM	RegyABC						
Huang, Iris T.	Sun	8:30 PM	RegyABC						
Hudson, Sharon P.	Tue	8:30 AM	BurlRte	Tue	2:30 PM	Wabash			
Huffman, Douglas	Mon	8:30 AM	GrandE						
Hug, J. William	Mon	8:30 AM	BurlRte						
Hughes, Marilyn F.	Mon	10:30 AM	Wabash						
Hungate, Gene	Mon	2:45 PM	MoPacif						
Hurst, Roy W.	Tue	8:30 AM	MoPacif						
Hurst-March, Robin	Mon	10:30 AM	RegncyA						
Hussain, Valery S.	Tue	4:00 PM	MoPacif						
Iwasyk, Marletta	Sun	7:00 PM	GrandD						
Jackson, David F.	Mon	1:00 PM	Frisco	Mon	4:00 PM	NYCentr	Tue	10:30 AM	Frisco
James, Robert K.	Mon	8:30 AM	RegncyC						
Jarrell, Ranald	Tue	10:30 AM	GrandB						
Jarvis, Tina	Mon	10:30 AM	Frisco	Mon	2:45 PM	Jeffersn			
Jbeily, Kamil A.	Tue	10:30 AM	IllCentrl						
Jeffrey, Kodi R.	Sun	7:00 PM	BurlRte						
Jegede, Olugbemiro	Mon	2:45 PM	GrandB	Tue	4:00 PM	RegncyC			
Jensen, Murray	Wed	10:30 AM	RegncyB						
Johnson, Judith	Sun	7:00 PM	GrandC						
Johnson, Judith	Sun	7:00 PM	GrandC	Mon	8:30 AM	IllCentrl			
Johnson, Sally	Mon	8:30 AM	Jeffersn						
Johnson, Valora M.	Wed	10:30 AM	GrandA						
Jones, Gail	Mon	1:00 PM	Jeffersn	Mon	2:45 PM	MoPacif	Tue	2:30 PM	NYCentr
Jones, Jeanne	Mon	4:00 PM	GrandC						
Jones, Leslie S.	Tue	4:00 PM	MoPacif						
Jones, Tricia	Mon	2:45 PM	Frisco						
Kahle, Jane Butler	Mon	8:30 AM	MoPacif	Tue	2:30 PM	GrandC			
Kamen, Michael	Mon	8:30 AM	BurlRte	Mon	10:30 AM	GrandE	Mon	2:45 PM	GrandC
Kao, Rong-Cheng	Mon	1:00 PM	MoPacif						
Kattmann, Ulrich	Mon	1:00 PM	RegncyB						
Katz, Phyllis	Tue	4:00 PM	RegncyC						
Kelly, Christine	Mon	1:00 PM	GrandE	Mon	2:45 PM	RegncyA			
Kelly, Gregory J.	Tue	8:30 AM	NYCentr						
Kelly, Paul	Wed	10:30 AM	GrandC						
Kempa, Richard	Mon	4:00 PM	GrandE						
Kerner, Nancy	Mon	1:00 PM	Frisco						
Kerr, Susan	Wed	10:30 AM	IllCentrl						
Kesidou, Sofia	Tue	10:30 AM	RegncyA						
Keys, Carolyn W.	Mon	10:30 AM	IllCentrl						
Khourey-Bowers, Claudia	Sun	7:00 PM	IllCentrl						
Kirk, Maria K.	Sun	8:30 PM	RegyABC						
Klapper, Michael H.	Mon	1:00 PM	GrandC						
Koba, Susan	Mon	1:00 PM	Jeffersn						
Koballa, Jr., Thomas R.	Sun	8:30 PM	RegyABC	Mon	10:30 AM	RegncyB			
Komorek, Michael	Mon	1:00 PM	RegncyB	Tue	8:30 AM	GrandB			

Kowalski, John	Mon	1:00 PM	Wabash						
Krajcik, Joseph P.	Sun	1:00 PM	IllCentrl	Mon	1:00 PM	GrandD	Mon	2:45 PM	GrandC
	Tue	4:00 PM	RegncyA						
Krockover, Gerald H.	Mon	1:00 PM	MoPacif						
Kurose, Akiko	Sun	7:00 PM	GrandD						
Kurth, Lori A.	Sun	7:00 PM	GrandA	Mon	4:00 PM	BurlRte			
Kyle, Jr., William C.	Mon	10:30 AM	RegncyC						
Labuda, Kay	Mon	8:30 AM	RegncyC						
Labudde, Peter	Wed	10:30 AM	GrandA						
Landis, Carol	Mon	1:00 PM	BurlRte						
Lane, Lena	Mon	10:30 AM	RegncyB						
Lang, Manfred	Tue	10:30 AM	RegncyB						
LaPorta, Tom	Mon	8:30 AM	RegncyC						
Larson, Jane O.	Mon	4:00 PM	GrandA						
LaRussa, Annette	Tue	10:30 AM	GrandC						
Latz, Mark S.	Sun	7:00 PM	Wabash	Tue	10:30 AM	NYCentr			
Lavoie, Derrick R.	Wed	10:30 AM	GrandC						
Lawan, Faulatu K.	Tue	4:00 PM	GrandA						
Lawlor, Francis	Mon	2:45 PM	Grand E						
Lawrence, Chris	Tue	8:30 AM	RegncyB						
Lawrenz, Frances	Mon	8:30 AM	GrandE						
Layman, John W.	Sun	8:30 PM	RegyABC						
Lazarowitz, Reuven	Mon	4:00 PM	RegncyB	Tue	2:30 PM	RegncyC			
Lederman, Norman G.	Mon	10:30 AM	NYCentr	Mon	4:00 PM	GrandE	Tue	10:30 AM	NYCentr
	Wed	10:30 AM	Wabash						
Lee, Cherin	Mon	1:00 PM	BurlRte						
Lee, Okhee	Mon	8:30 AM	GrandA	Mon	1:00 PM	GrandA			
Lefurgy, Scott T.	Tue	10:30 AM	GrandA						
Lennon, Patrick	Alan	Tue	2:30 PM	RegncyC					
Leonard, Mary Alice	Tue	8:30 AM	GrandC						
Letts, IV, William J.	Mon	8:30 AM	NYCentr	Tue	8:30 AM	GrandA	Wed	10:30 AM	GrandA
Lewis, JoAnn	Tue	8:30 AM	RegncyA						
Lewis, Scott P.	Sun	7:00 PM	BurlRte						
Li, Anna	Mon	10:30 AM	GrandA						
Liang, Ling L.	Tue	10:30 AM	GrandB						
Lin, Shu Hua	Tue	4:00 PM	RegncyC						
Lin, Weir-Sen	Mon	10:30 AM	MoPacif						
Lindauer, Ivo	Tue	2:30 PM	Wabash						
Liu, Chin-Tang	Tue	8:30 AM	RegncyA						
Liu, Chin-Tang	Tue	8:30 AM	RegncyA						
Lochhead, Jack	Tue	10:30 AM	Frisco						
Lockwood, Richard	Tue	10:30 AM	NYCentr						
Lohrke, Charles T.	Mon	2:45 PM	RegncyA						
Lord, Thomas R.	Tue	4:00 PM	IllCentrl						
Lorsbach, Tony	Wed	10:30 AM	GrandB						
Loucks-Horsley, Susan	Mon	8:30 AM	RegncyB						
Loving, Cathleen C.	Mon	10:30 AM	NYCentr	Tue	2:30 PM	BurlRte			
Lowrey, Kristin	Mon	1:00 PM	GrandD						
Lucas, Keith B.	Mon	8:30 AM	GrandE	Mon	10:30 AM	GrandD	Mon	2:45 PM	NYCentr
	Wed	10:30 AM	RegncyC						
Lumpe, Andrew T.	Mon	10:30 AM	MoPacif	Tue	8:30 AM	Wabash	Tue	2:30 PM	IllCentrl
Lunetta, Vincent N.	Mon	4:00 PM	GrandF						
Lynch, Sharon	Mon	1:00 PM	GrandA						
MacIsaac, Douglas	Mon	8:30 AM	RegncyC						
Magnusson, Shirley J.	Wed	10:30 AM	BurlRte						
Marble, Stephen	Mon	10:30 AM	GrandE						
Markle, Glenn C.	Mon	4:00 PM	BurlRte						
Marlow, Michael	Mon	8:30 AM	GrandC						
Martinello, Marian L.	Tue	2:30 PM	GrandB						
Mason, Cheryl L.	Mon	4:00 PM	RegncyA	Tue	4:00 PM	IllCentrl	Wed	10:30 AM	RegncyB

Mason, Diana	Tue 10:30 AM	GrandA	Tue 4:00 PM	GrandB		
Matkins, Juanita Jo	Mon 1:00 PM	GrandB				
Matthews, Michael R.	Mon 10:30 AM	NYCentr	Tue 4:00 PM	NYCentr		
Matthews, Susan	Tue 10:30 AM	RegncyA				
Mattson, Sue	Mon 4:00 PM	Jeffersn	Wed 10:30 AM	GrandB		
McArthur, Julia M.	Mon 8:30 AM	GrandC				
McClurg, Patricia A.	Mon 8:30 AM	IllCentrl				
McConney, Amanda	Woods Tue	8:30 AM	Wabash Tue	2:30 PM	BurlRte	
McConney, Andrew	Tue 8:30 AM	Wabash				
McCormack, Alan J.	Tue 4:00 PM	IllCentrl				
McDonald, Robert B.	Tue 2:30 PM	Jeffersn				
McDonough, Maureen	Mon 10:30 AM	MoPacif				
McFadden, Charles	Mon 8:30 AM	Wabash	Mon 4:00 PM	RegncyA		
McGinn, Michelle K.	Tue 2:30 PM	RegncyA	Wed 10:30 AM	RegncyC		
McGinnis, J. Randy	Tue 8:30 AM	IllCentrl				
McGlamery, Sheryl	Mon 8:30 AM	RegncyC				
McGrew-Zoubi, Robin	Tue 2:30 PM	Wabash				
McKenzie, Woodrow L.	Tue 2:30 PM	NYCentr	Tue 4:00 PM	RegncyB		
McLeod, Richard	Mon 2:45 PM	Grand E				
McLoughlin, Andrea	Tue 4:00 PM	RegncyC				
McMahon, Maureen M.	Mon 10:30 AM	GrandB	Mon 1:00 PM	GrandE		
McRobbie, Campbell J.	Mon 10:30 AM	GrandD	Mon 2:45 PM	NYCentr	Mon 4:00 PM	Wabash
	Wed 10:30 AM	RegncyC				
Meadows, Larry	Sun 7:00 PM	GrandC				
Meadows, Lee	Sun 7:00 PM	Wabash				
Mei, Wang	Mon 8:30 AM	GrandD				
Meichtry, Yvonne J.	Mon 10:30 AM	NYCentr				
Meisner, Jerry	Sun 8:30 PM	RegyABC				
Meyers, Karen	Mon 2:45 PM	GrandA				
Mhlongo, Nkosinathi	Mon 8:30 AM	Jeffersn				
Miller, Anne Courtney	Mon 8:30 AM	Jeffersn				
Miller, Raymond B.	Mon 8:30 AM	GrandB				
Milne, Catherine	Sun 7:00 PM	NYCentr	Mon 10:30 AM	BurlRte	Tue 2:30 PM	MoPacif
Minger, Mark A.	Mon 8:30 AM	GrandE				
Mintzes, Joel J.	Mon 2:45 PM	RegncyA				
Misiak, Julia Anne	Mon 10:30 AM	Wabash				
Mitchell, Elliott	Sun 9:30 AM	IllCentrl				
Mize, Gayle	Tue 10:30 AM	GrandA				
Monhardt, Becky	Mon 4:00 PM	GrandC				
Monhardt, Leigh	Mon 4:00 PM	GrandC				
Moore, Richard W.	Mon 8:30 AM	GrandD				
Morgan, Wayne R.	Tue 10:30 AM	GrandA				
Morritz, Trudy	Mon 10:30 AM	GrandA				
Moscovici, Hedy	Mon 10:30 AM	IllCentrl	Tue 8:30 AM	MoPacif		
Moses, Diane	Tue 2:30 PM	GrandB				
Mugandani, S.	Wed 10:30 AM	IllCentrl				
Muire, Chris	Mon 8:30 AM	MidSpec				
Muller, Carol	Tue 4:00 PM	MoPacif				
Murfin, Brian	Mon 4:00 PM	GrandB				
Naaman, Ron	Sun 8:30 PM	RegyABC				
Naidoo, Prem	Mon 2:45 PM	GrandB				
Naizer, Gilbert L.	Mon 2:45 PM	GrandC				
Nakhleh, Mary B.	Mon 1:00 PM	GrandD	Mon 4:00 PM	BurlRte		
Neal, Mary	Sun 7:00 PM	GrandC				
Nelsen, Karla	Mon 2:45 PM	BurlRte				
Nelson, Barbara	Tue 8:30 AM	IllCentrl				
Nelson, Terry	Sun 7:00 PM	GrandC				
Nesbit, Catherine R.	Mon 8:30 AM	Jeffersn				
Neves, Margarida S.	Tue 10:30 AM	Jeffersn				
Niaz, Mansoor	Mon 1:00 PM	GrandD	Tue 8:30 AM	Frisco	Wed 10:30 AM	Wabash

Nichols, Kim	Mon	1:00 PM	IllCentrl	Mon	4:00 PM	Jeffersn			
Nichols, Sharon	Sun	7:00 PM	NYCentr	Mon	8:30 AM	GrandA	Mon	10:30 AM	RegncyB
	Wed	10:30 AM	GrandB						
Nickelson, Dennis	Mon	2:45 PM	BurlRte						
Nicolaos, Valanides	Tue	10:30 AM	Wabash						
Niedderer, Hans	Mon	4:00 PM	GrandF	Tue	8:30 AM	GrandB			
Nodurft, Susan J.	Tue	4:00 PM	GrandC						
Norman, Katherine I.	Mon	10:30 AM	Jeffersn	Tue	10:30 AM	IllCentrl			
Norman, Obed	Mon	10:30 AM	BurlRte	Tue	4:00 PM	GrandB			
O'Donnell, Angela	Tue	2:30 PM	RegncyC						
Obermeier, Donna	Mon	1:00 PM	GrandE						
Odom, A. Louis	Wed	10:30 AM	RegncyB						
Oey, Esther	Sun	7:00 PM	BurlRte						
Ogunsola-Bandele, Mercy F.	Tue	4:00 PM	GrandA						
Okebukola, Peter A. O.	Mon	2:45 PM	GrandB	Tue	4:00 PM	RegncyC			
Oliveira, Mauricia	Tue	10:30 AM	Jeffersn						
Oliver, J. Steve	Mon	8:30 AM	GrandB	Mon	10:30 AM	RegncyA	Mon	1:00 PM	IllCentrl
Olness, Valerie Keeling	Mon	1:00 PM	GrandE						
Olsen, Eric	Mon	4:00 PM	GrandC						
Orion, Nir	Mon	4:00 PM	GrandE						
Osborne, M.D.	Mon	10:30 AM	GrandA						
Osborne, Margery	Sun	7:00 PM	GrandA						
Padilla, Michael J.	Sun	8:30 PM	RegyABC	Mon	8:30 AM	RegncyB			
Palmer, Troy D.	Sun	7:00 PM	Frisco						
Palmeri, Amy B.	Tue	10:30 AM	MoPacif						
Parke, Helen M.	Mon	8:30 AM	Jeffersn	Mon	4:00 PM	GrandD			
Parker, Dawn	Sun	7:00 PM	IllCentrl						
Parker, Joyce	Mon	8:30 AM	RegncyA	Mon	4:00 PM	Jeffersn			
Parker, Lesley H.	Sun	7:00 PM	NYCentr	Mon	1:00 PM	GrandF	Tue	2:30 PM	GrandA
Parsons, Sharon	Mon	1:00 PM	MoPacif	Mon	2:45 PM	GrandA	Tue	10:30 AM	RegncyB
Patterson, B. Patricia	Mon	10:30 AM	Jeffersn						
Pavone, Mary L.	Tue	4:00 PM	MoPacif						
Pearsall, N. Renee	Mon	2:45 PM	RegncyA						
Pedersen, Jon E.	Mon	10:30 AM	MoPacif						
Penick, John	Tue	8:30 AM	RegncyA						
Penner, James	Mon	1:00 PM	Frisco						
Perry, Kimberly	Mon	8:30 AM	Wabash						
Peters, Joseph	Sun	7:00 PM	MidSpec						
Peterson, Rita W.	Tue	4:00 PM	IllCentrl						
Petrosino, Anthony	Mon	8:30 AM	Frisco						
Plummer, Donna M.	Mon	10:30 AM	RegncyA	Mon	1:00 PM	MoPacif			
Poel, Robert	Mon	2:45 PM	RegncyA						
Pomeroy, Deborah	Sun	7:00 PM	GrandA						
Ponte De Chacin, Carmen	Tue	8:30 AM	Frisco						
Ponton, Malinda	Sun	7:00 PM	GrandC						
Postlewaite, Elizabeth M.	Tue	4:00 PM	RegncyC						
Poth, Jim	Tue	2:30 PM	GrandC						
Powell, Kathryn	Tue	2:30 PM	RegncyC						
Powell, Richard R.	Mon	8:30 AM	Wabash						
Prather, J. Preston	Mon	1:00 PM	GrandB	Mon	4:00 PM	RegncyB			
Priestley, Holly	Mon	8:30 AM	GrandD						
Priestley, William J.	Mon	8:30 AM	GrandD						
Prinkey, Jennifer	Tue	10:30 AM	GrandA						
Pugh, Ava	Mon	4:00 PM	GrandD						
Pulos, Steven	Tue	2:30 PM	RegncyC						
Purkiss, Christine	Mon	8:30 AM	Wabash						
Pyle, Eric J.	Sun	8:30 PM	RegyABC	Mon	2:45 PM	GrandB	Tue	2:30 PM	RegncyC
Queitzsch, Mary	Tue	2:30 PM	Wabash						
Radford, David L.	Sun	7:00 PM	IllCentrl						
Raghavan, Kalyami	Mon	8:30 AM	Frisco						

Rainsford, Ann D.	Tue 2:30 PM RegncyC		
Raizen, Senta	Mon 8:30 AM RegncyC		
Ramseur, Aletha	Mon 8:30 AM NYCentr		
Ramsey, Linda L.	Sun 7:00 PM IllCentrl		
Raubenheimer, Dianne	Mon 8:30 AM Jeffersn		
Reiner, Miriam	Tue 10:30 AM Jeffersn		
Reinhold, Peter	Mon 10:30 AM IllCentrl		
Rennie, Léonie J.	Mon 1:00 PM GrandF	Mon 2:45 PM Jeffersn	Mon 4:00 PM GrandE
	Tue 2:30 PM GrandA		
Reyes-Herrera, Lilia	Mon 8:30 AM MidSpec	Mon 1:00 PM Wabash	
Rice, Diana C.	Tue 2:30 PM RegncyC		
Richardson, Lon	Mon 4:00 PM NYCentr		
Richmond, Gail	Sun 7:00 PM GrandA		
Riggs, Iris	Tue 2:30 PM IllCentrl		
Riley, Dana	Mon 8:30 AM MoPacif	Tue 4:00 PM RegncyC	
Riley, Joseph P.	Mon 10:30 AM RegncyB	Mon 2:45 PM RegncyB	
Rillero, Peter	Sun 7:00 PM GrandB	Tue 10:30 AM GrandB	
Rivard, Leonard P.	Mon 1:00 PM GrandE		
Roberts, Joyce M.	Tue 4:00 PM GrandC		
Robinson, Michael	Mon 8:30 AM Wabash		
Robinson, Scott	Tue 2:30 PM RegncyC		
Rochell, Deirdra	Mon 1:00 PM Jeffersn		
Rodriguez, Alberto J.	Sun 8:30 PM RegyABC		
Rodriquez, Bill	Mon 8:30 AM Frisco		
Roempler, Kimberly S.	Tue 4:00 PM RegncyC		
Rogers, Laura N.	Tue 8:30 AM GrandC		
Rogg, Steve	Mon 8:30 AM MoPacif		
Rojas de Astudillo, Luisa	Mon 1:00 PM GrandD		
Rollnick, Marissa	Mon 10:30 AM GrandE		
Ron, Salit	Tue 2:30 PM RegncyC		
Ronkin, Jacob	Sun 8:30 PM RegyABC		
Rop, Charles Jay	Wed 10:30 AM GrandA		
Roseman, Jo Ellen	Mon 8:30 AM RegncyB	Mon 1:00 PM GrandA	Tue 10:30 AM RegncyA
Roth, Kathleen J.	Sun 7:00 PM GrandA	Mon 8:30 AM IllCentrl	Wed 10:30 AM BurlRte
Roth, Wolff-Michael	Mon 10:30 AM GrandD	Tue 8:30 AM GrandB	Tue 10:30 AM Jeffersn
	Wed 10:30 AM RegncyC		
Rowe, Mary Budd	Mon 2:45 PM Grand E		
Roychoudhury, Anita	Sun 7:00 PM NYCentr	Mon 8:30 AM MoPacif	Tue 2:30 PM GrandA
Rua, Melissa	Mon 1:00 PM Jeffersn		
Rubba, Pete	Wed 10:30 AM GrandC		
Rubin, Susan	Mon 8:30 AM GrandD		
Rusk, Sharyn	Tue 2:30 PM RegncyC		
Russell, David	Wed 10:30 AM RegncyC		
Rye, James A.	Wed 10:30 AM GrandC		
Sabre, Mara	Mon 1:00 PM Wabash		
Sanders, Jo	Mon 4:00 PM RegncyC		
Sandys, David	Mon 8:30 AM RegncyA		
Sartoris, Mary	Mon 8:30 AM Frisco		
Saturnelli, Annette	Mon 4:00 PM GrandB		
Scantlebury, Kathryn	Mon 8:30 AM NYCentr	Mon 1:00 PM GrandF	Tue 8:30 AM GrandA
	Tue 4:00 PM Jeffersn	Wed 10:30 AM GrandA	
Schaller, John	Mon 4:00 PM MoPacif		
Scharmann, Lawrence C.	Mon 1:00 PM BurlRte	Mon 2:45 PM Jeffersn	Wed 10:30 AM GrandC
Schmidt, Hans-Jürgen	Mon 4:00 PM Wabash		
Schmidt, Julie	Mon 8:30 AM NYCentr	Wed 10:30 AM BurlRte	
Schmuckler, Joseph S.	Mon 8:30 AM GrandD		
Schnipper, Linda	Tue 2:30 PM RegncyC		
Scholer, Anne-Marie	Tue 4:00 PM GrandA		
Schoon, Kenneth J.	Tue 4:00 PM GrandC		
Schroeder, Patricia	Mon 1:00 PM GrandD		

Settlage, Jr., John	Mon	10:30 AM	IllCentrl	Wed	10:30 AM	RegncyB			
Shaka, Farella L.	Tue	2:30 PM	RegncyC						
Shapiro, Bonnie	Mon	8:30 AM	BurlRte						
Shaw, Rose	Tue	8:30 AM	IllCentrl						
Shaw, Jr., Edward L.	Mon	10:30 AM	Frisco						
She, Hsiao-Ching	Tue	4:00 PM	GrandA						
Shea, Trudy	Mon	4:00 PM	RegncyB						
Shepardson, Daniel P.	Mon	2:45 PM	BurlRte	Tue	4:00 PM	RegncyA			
Sherwood, Robert D.	Sun	8:30 PM	RegyABC	Mon	2:45 PM	Frisco			
Shipman, Harry L.	Mon	1:00 PM	Jeffersn						
Shore, Linda S.	Sun	7:00 PM	BurlRte	Tue	4:00 PM	Jeffersn			
Shroyer, Gail M.	Sun	7:00 PM	MoPacif	Mon	8:30 AM	Jeffersn	Mon	1:00 PM	BurlRte
	Mon	4:00 PM	GrandA	Tue	2:30 PM	IllCentrl	Wed	10:30 AM	IllCentrl
Shymansky, James A.	Mon	2:45 PM	RegncyA	Mon	4:00 PM	GrandC			
Sickle, Meta Van	Mon	10:30 AM	Jeffersn	Tue	10:30 AM	NYCentr	Wed	10:30 AM	GrandC
Simmons, Patricia	Mon	8:30 AM	RegncyC	Tue	4:00 PM	GrandA			
Simpson, Dorothy	Sun	7:00 PM	GrandD						
Simpson, William D.	Sun	8:30 PM	RegyABC						
Sirochman, Rudy F.	Mon	10:30 AM	GrandD						
Skipper, Jo El J.	Mon	2:45 PM	RegncyA						
Skov, Neil	Mon	2:45 PM	Frisco						
Slough, Scott	Tue	2:30 PM	Wabash						
Smith, Coralee S.	Mon	10:30 AM	Frisco						
Smith, Deborah C.	Mon	10:30 AM	GrandA	Wed	10:30 AM	BurlRte			
Smith, Edward L.	Mon	4:00 PM	BurlRte	Tue	10:30 AM	RegncyA			
Smith, John J.	Mon	2:45 PM	MoPacif						
Smith, Michael J.	Mon	8:30 AM	NYCentr						
Songer, Nancy B	Mon	1:00 PM	Frisco	Mon	2:45 PM	GrandD			
Soopokakit, Benjalug	Mon	10:30 AM	MoPacif						
Spector, Barbara S.	Mon	8:30 AM	RegncyC						
Speering, Wendy	Mon	4:00 PM	GrandE						
Spiegel, Samuel A.	Sun	7:00 PM	Wabash						
Spinella, Gary	Mon	1:00 PM	GrandE						
Spitzer, Billy	Tue	10:30 AM	Frisco						
Spivey, Kristy	Mon	10:30 AM	MoPacif						
Staver, John	Mon	1:00 PM	GrandD						
Stepans, Joseph	Mon	8:30 AM	IllCentrl						
Steuck, Kurt	Mon	8:30 AM	Frisco						
Stobler, Milton	Mon	10:30 AM	RegncyB						
Stocklmayer, Susan M.	Sun	7:00 PM	NYCentr	Tue	10:30 AM	NYCentr	Tue	2:30 PM	MoPacif
Stofflett, René T.	Tue	8:30 AM	Wabash	Tue	10:30 AM	GrandC			
Stuessy, Carol L.	Sun	7:00 PM	IllCentrl	Tue	10:30 AM	Frisco			
Sutman, Frank X.	Mon	8:30 AM	GrandD						
Sweeney, Aldrin E.	Mon	8:30 AM	GrandA						
Tal, Revital T.	Mon	4:00 PM	RegncyB						
Talsma, Valerie L.	Tue	4:00 PM	GrandC						
Taylor, Beatrice L.	Mon	1:00 PM	Wabash						
Taylor, Peter	Tue	2:30 PM	MoPacif	Tue	2:30 PM	GrandC			
Templin, Mark	Wed	10:30 AM	Jeffersn						
Thomas, Jeff A.	Sun	8:30 PM	RegyABC						
Tims, Joanne	Mon	8:30 AM	MoPacif	Tue	2:30 PM	RegncyC	Tue	4:00 PM	Wabash
Tippins, Deborah J.	Sun	7:00 PM	NYCentr	Aun	8:30 PM	RegyABC	Mon	8:30 AM	RegncyB
Tobin, Kenneth	Mon	8:30 AM	MoPacif	Wed	10:30 AM	RegncyC			
Toker, Jonathan	Tue	4:00 PM	Frisco						
Townsend, Julie	Sun	7:00 PM	GrandC						
Trax, Mark F.	Tue	8:30 AM	RegncyA	Tue	2:30 PM	RegncyB			
Treagust, David F.	Sun	7:00 PM	Jeffersn	Aun	8:30 PM	RegyABC	Mon	1:00 PM	IllCentrl
	Mon	4:00 PM	GrandF						
Trowbridge, John E.	Mon	10:30 AM	NYCentr	Tue	8:30 AM	Wabash			
Tuan, Hsiao-lin	Mon	1:00 PM	MoPacif						

Tyson, Louise	Sun	7:00 PM	Jeffersn	Aun	8:30 PM	RegyABC			
Underwood, Scott A	Sun	7:00 PM	GrandB						
van Zee, Emily H.	Sun	7:00 PM	GrandD						
Varanka-Martin, MaryAnn	Mon	4:00 PM	GrandA						
Varelas, Maria	Tue	2:30 PM	Wabash						
Varrella, Gary	Sun	7:00 PM	MoPacif	Mon	4:00 PM	GrandC	Tue	8:30 AM	RegncyA
	Tue	2:30 PM	RegncyB						
Vazquez-Abad, Jesus	Mon	4:00 PM	GrandE	Tue	4:00 PM	Frisco			
Veal, William R.	Mon	2:45 PM	Jeffersn	Tue	10:30 AM	Wabash	Tue	4:00 PM	BurlRte
Venville, Grady	Sun	7:00 PM	Jeffersn						
Vesilind, Elizabeth M.	Tue	2:30 PM	NYCentr						
Vidakovic, Draga	Tue	8:30 AM	GrandC						
Violi, Enrico	Wed	10:30 AM	GrandA						
Volkmann, Mark	Mon	4:00 PM	Jeffersn						
Vopava, Judy	Sun	7:00 PM	MoPacif						
Voss, Burton E.	Sun	8:30 PM	RegyABC						
Waldoch, Terez	Wed	10:30 AM	GrandB						
Waldon, Brenda	Mon	10:30 AM	RegncyB						
Waldrip, Bruce G.	Mon	10:30 AM	RegncyA						
Wallace, John	Tue	10:30 AM	Jeffersn	Wed	10:30 AM	RegncyB			
Wallace, Josephine D.	Mon	8:30 AM	Jeffersn						
Wandersee, James H.	Sun	7:00 PM	BurlRte	Mon	10:30 AM	NYCentr	Tue	8:30 AM	Wabash
	Tue	4:00 PM	Wabash						
Wang, Su-Shiang	Mon	8:30 AM	GrandE						
Warden, Melissa A.	Tue	8:30 AM	MoPacif	Tue	2:30 PM	RegncyC			
Watanabe, Tad	Tue	8:30 AM	IllCentrl						
Watters, James	Mon	8:30 AM	GrandE	Tue	10:30 AM	GrandC	Tue	2:30 PM	IllCentrl
Weamer, Dan Kaur	Wed	10:30 AM	IllCentrl						
Weller, Herman G.	Mon	8:30 AM	Wabash	Tue	4:00 PM	RegncyC			
Wendel, Carlton	Mon	2:45 PM	BurlRte						
Westbrook, Susan L.	Mon	10:30 AM	Wabash	Tue	8:30 AM	GrandC	Wed	10:30 AM	RegncyC
Wheeler, Christopher	Mon	10:30 AM	MoPacif						
White, Arthur L.	Mon	1:00 PM	GrandC	Mon	2:45 PM	MoPacif	Wed	10:30 AM	RegncyA
Whitworth, Joan M.	Tue	8:30 AM	BurlRte						
Wier, Betty A.	Mon	1:00 PM	Wabash						
Wieseman, Katherine	Sun	8:30 PM	RegyABC	Mon	8:30 AM	RegncyB	Mon	2:45 PM	RegncyB
Wiggins, John R.	Mon	1:00 PM	BurlRte	Mon	4:00 PM	Jeffersn			
Williamson, Vickie M.	Mon	2:45 PM	GrandD	Mon	4:00 PM	RegncyB			
Wilson, John T.	Mon	10:30 AM	MoPacif						
Wilson, Julie L.	Tue	4:00 PM	GrandB						
Winer, Laura R.	Mon	4:00 PM	GrandE	Tue	4:00 PM	Frisco			
Workman, Margaret A.	Mon	10:30 AM	GrandB						
Wright, Emmett L.	Sun	7:00 PM	MoPacif	Tue	10:30 AM	GrandA	Tue	4:00 PM	GrandB
	Wed	10:30 AM	IllCentrl						
Wu, I-Lin	Wed	10:30 AM	RegncyB						
Yager, Robert E.	Sun	7:00 PM	MoPacif	Mon	8:30 AM	RegncyC	Tue	8:30 AM	RegncyA
	Tue	2:30 PM	Wabash						
Yang, Jong-Hsiang	Wed	10:30 AM	RegncyB						
Yates, Julie L.	Mon	1:00 PM	GrandF						
Yerrick, Randy K.	Sun	7:00 PM	IllCentrl	Sun	8:30 PM	RegyABC			
Yore, Larry D.	Mon	8:30 AM	GrandB	Mon	1:00 PM	RegncyB	Mon	4:00 PM	GrandC
Yu, Shu-mey	Mon	8:30 AM	GrandC						
Zeidler, Dana L.	Tue	10:30 AM	NYCentr						
Zeilik, Michael	Mon	1:00 PM	Jeffersn						
Zembal, Carla M.	Mon	2:45 PM	GrandC						
Zhou, Mulian	Mon	8:30 AM	GrandD						
Zietsman, Aletta	Mon	10:30 AM	Wabash						
Zoller, Uri	Tue	8:30 AM	Wabash	Tue	2:30 PM	RegncyA			
Zollman, Dean A.	Mon	1:00 PM	Frisco						
Zsodos, Hepsi	Tue	8:30 AM	GrandA						